The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Entered as second-class matter, July 2, 1907, at the Chicago, Illinois, Postoffice, under the Act of March 3, 1879

CLINTON S. DARLING, Editor
CHARLES A. BRESKIN, Adv. Mgr.
E. M. GIBSON, Asst. Mgr.
JOSEPH K. COSTELLO, Central Rep.
N. C. ROCKWOOD, Advisory Editor
H. E. HOPKINS, Associate Editor
C. H. FULLER, New York Rep.
LESTER N. WEBER, Western Rep.
GEO. P. MILLER, Manager

SUBSCRIPTION—Two dollars a year to United States and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies.

TO SUBSCRIBERS—Date on wrappers indicate issue with which your subscription expires. In writing to have address changed, give old as well as new address

Published Every Other Saturday by
Tradepress Publishing Corporation
542 South Dearborn Street, Chicago
Office New York Representative: 101 West 41st Street

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W. D. CALLENDER, President
N. C. ROCKWOOD, Vice-President
GEO. P. MILLER, Treasurer
C. O. NELSON, Secretary

Volume 25 July 29, 1922 Number 15

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Gathering Experience

That competent operators and managers in the rock products industries have rounded out their experience and added to their knowledge through regular reading is no secret. Nor is it a new fact that one of the most important sources of this regular reading for men of these industries is ROCK PRODUCTS. That is why the references to this magazine are frequent wherever operators get together, in large groups or small, in public gatherings or informal groups.

It was not at all surprising to hear Irving Warner, formerly of the Charles Warner Co. and now general manager of the American Lime and Stone Co., modestly state at a recent meeting of the National Lime Association, referring to rotary lime burning kilns, that "my own experience has been confined to that gained from one kiln at Cedar Hollow, together with what experience I have been able to accumulate by reading the articles in such magazines as ROCK PRODUCTS and by visiting other plants."

Mr. Warner's declaration was in itself of little importance, perhaps, but there could be no more sincere testimonial of the high esteem with which ROCK PRODUCTS is held in the industries it serves. It is everywhere accepted as the alert, progressive, authoritative, and ever-helpful magazine for producers of rock products, and its years of faithful service have made it as much a part of these industries as any plant or operator or association in these industries.

*

Experience Made to Order

The experience on which a manager's ability is based may come from three general sources, as Mr. Warner has implied—personal contact with work with which he is connected, visits to other plants, and the reading of articles on other plants. Personal visits are one of the most broadening sources of experience, but they are expensive and consume valuable time as well as money.

The best substitute for these visits are accurate and comprehensive reports of visits made by trained observers whose viewpoint is that of the manager or operator who wishes to absorb new ideas for future adaptation in his own plant.

ROCK PRODUCTS has several of these trained observers covering all parts of the country, and the net result to the reader is a volume of experience which would cost him at least four months of travel and $3000 of expense money each year to secure at first hand.

During the past two months, for example, four different representatives seeking editorial material have visited more than 60 plants in the rock products industries and have traveled more than 4000 miles by automobile and nearly that much by train in order to secure for the readers of ROCK PRODUCTS the latest, the most interesting, and the most authentic information available.

Perhaps it is because ROCK PRODUCTS spares no expense in searching out this information that it is accepted so fully by the industries it represents, as Mr. Warner has so clearly demonstrated of the quotation from him given above.

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Plain Facts about Truck Loading

No. 1. A Haiss Loader will do more work at less cost, because the machine does all the work—all the time.

Many machines are one-man machines *except* ——. But there's no "except" with a Haiss Loader. It is the *only machine* that has all three motions needed for full efficiency loading. It *loads* itself, *feeds* itself and *crowds* into the pile, simultaneously.

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The proof of greater work-ability is evidenced by the fact that *every Haiss bucket* digs and elevates *a heaping load.* Do others?

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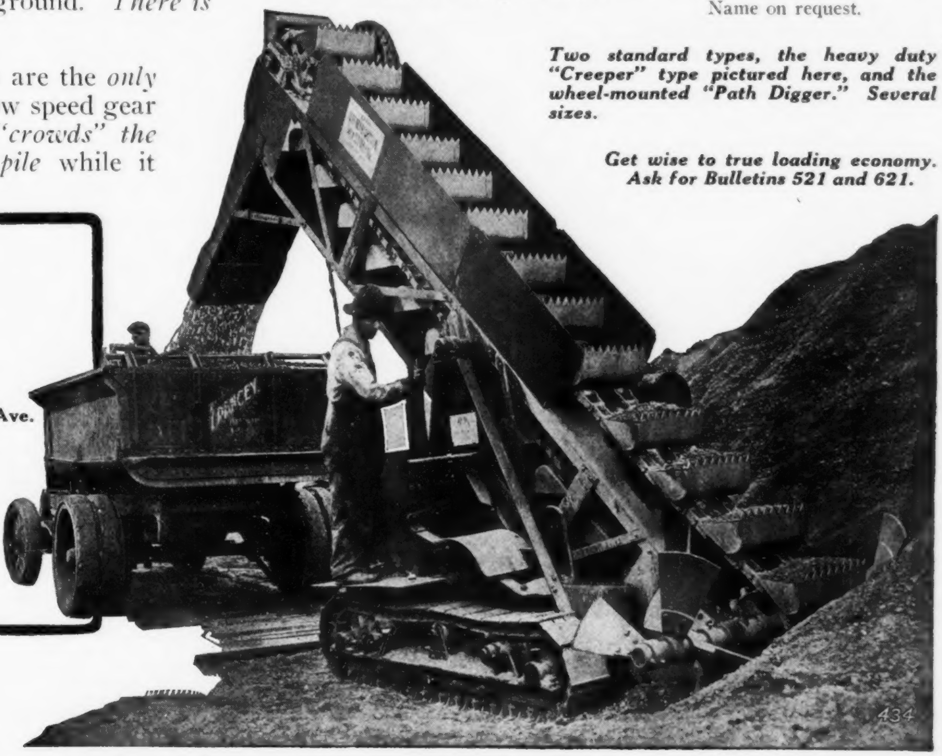
Name on request.

Two standard types, the heavy duty "Creeper" type pictured here, and the wheel-mounted "Path Digger." Several sizes.

Get wise to true loading economy. Ask for Bulletins 521 and 621.



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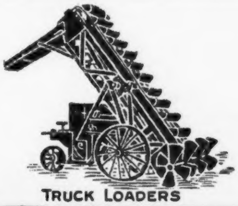
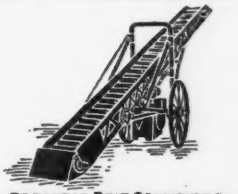


TRUCK LOADERS

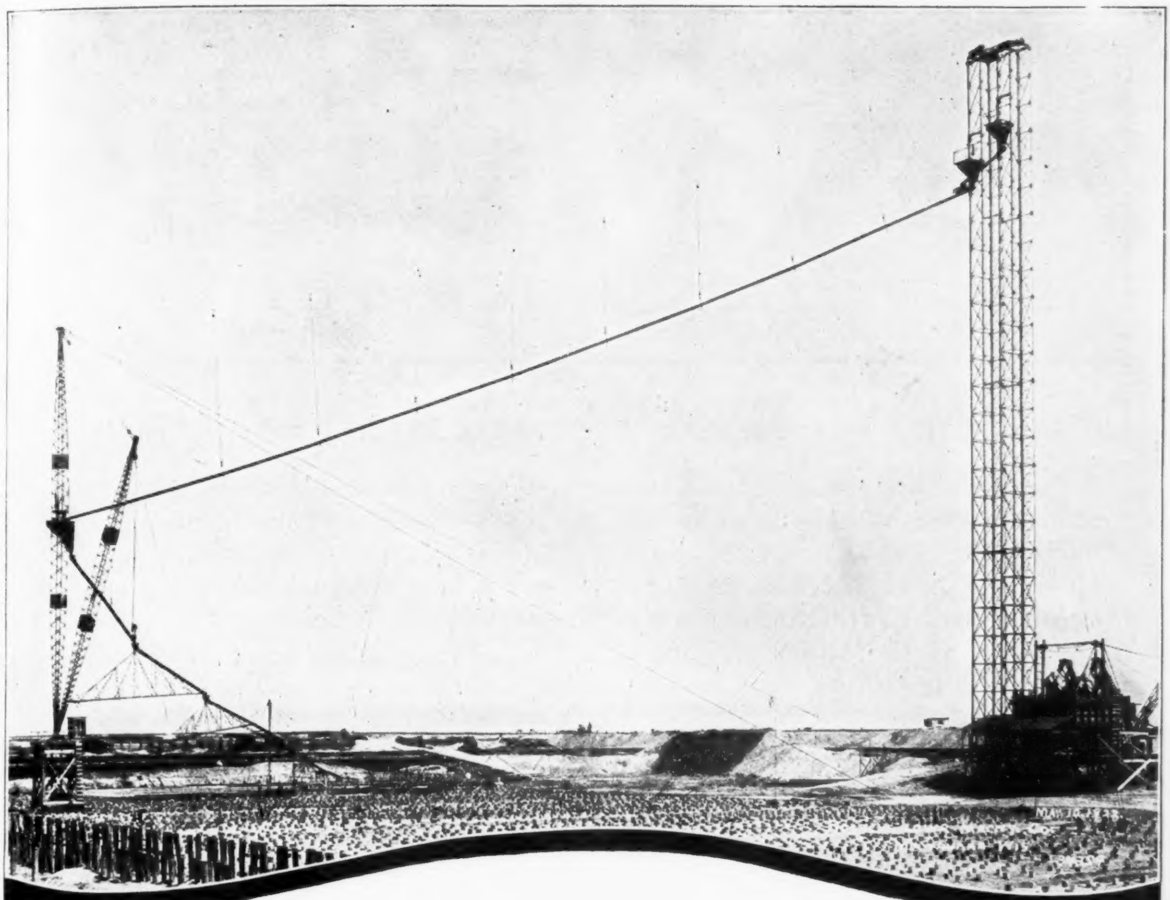
HAISS

MATERIALS HANDLING EQUIPMENT

CLAM SHELL BUCKETS



PORTABLE BELT CONVEYORS



Rock Products

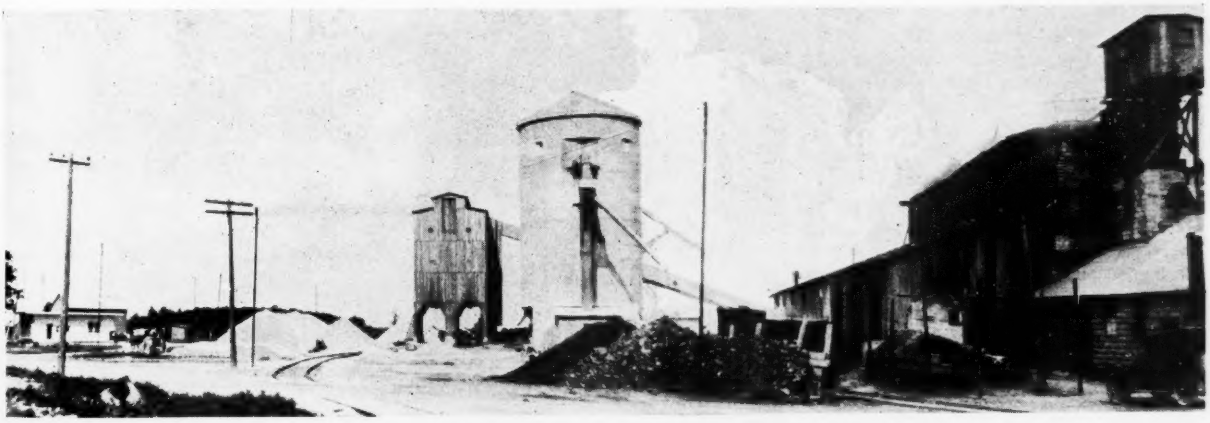
Volume XXV Chicago, July 29, 1922 Number 15

From Quarry to Finished Product with One Crusher Only

The John Herzog & Sons crushing plant, at Forest, Ohio, differs from other rock plants in that all the crushing, from start to finish, is done by one hammer mill. This plant also stores considerable quantities of the finer commercial sizes

By Joseph K. Costello

THERE are several details of the rock-crushing plant operated by the firm of John Herzog & Sons, at Forest, Ohio, that differentiate it from other plants of its kind. Among the most notable is the introduction of a Williams mammoth crusher. This mill does all the crushing from the time the quarried stone enters the crusher until it has become a finished product. While this type of mill is used generally in the cement industry, it is new to the operators of rock plants.

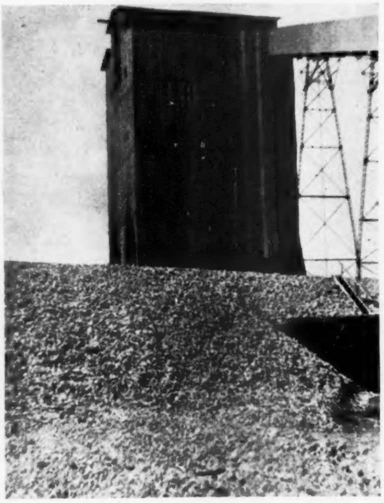


The plant, from the office on the left to the lime plant on the right

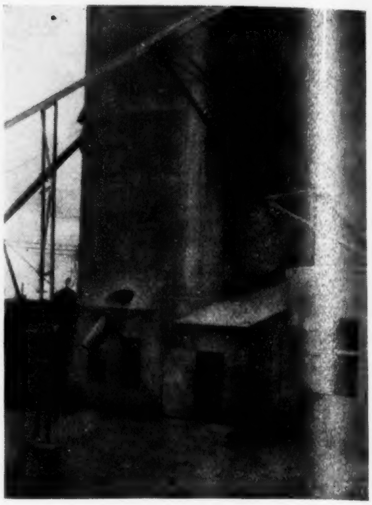
Quarry-run rock ready for crusher

Quarry and crusher plant

The feed to the crusher



Kiln-stone storage in front of screening plant



Lime storage silos

In installing this Williams crusher the Herzogs have made the operation of their mill very simple. This crusher will take rock as large as 36 in. and reduce it from 12 in. and finer to 1½ in. and finer.

The quarry, situated on the Big Four railroad about 3½ miles out of Forest, is being worked in a semicircle about one-half mile long and about 35 ft. face. What little overburden there is to be removed is loaded by an old Marion steam shovel into quarry cars and dumped into the abandoned sections of the quarry.

Very little secondary blasting is required as almost all the rock breaks up into sizes that can be handled by the crusher. Rock is loaded by a No. 40 Marion shovel equipped with a 1¼ yd. bucket on self-dumping quarry cars that are hauled to the crusher house by Plymouth gasoline locomotives, of which the company owns three, one 3-ton and two 6-ton. The floor of the crusher house is level with the quarry and the rock is dumped about 6 ft. on a 48-in. steel pan conveyor which lifts it to the mouth of the mill.

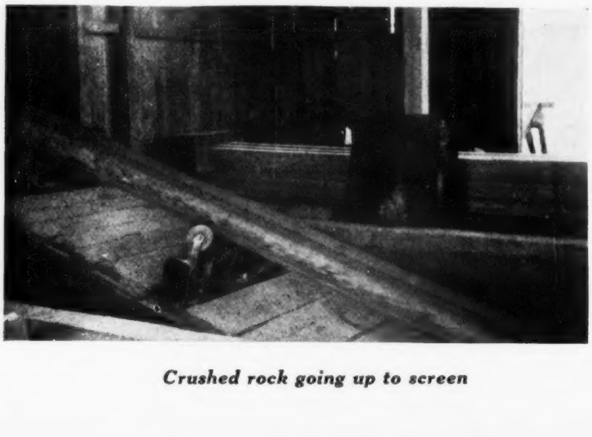
This mammoth crusher has a capacity of about 150 tons per hour and reduces the rock from 12 in. and finer to 1½ in. and finer. At present it is set to turn out 12 in. rock so as to give kiln rocks for the lime plant. The mill is driven by a direct-connected 150 hp. three-phase, 440-volt General Electric induction motor which requires a starting current of 225 amp. and an operating current, varying with conditions of load, of from 60 to 90 amp. The feed conveyor is driven by a belt from the driving shaft of the mill. A clutch arrangement permits starting or stopping independent of the mill.

This machine does all the crushing

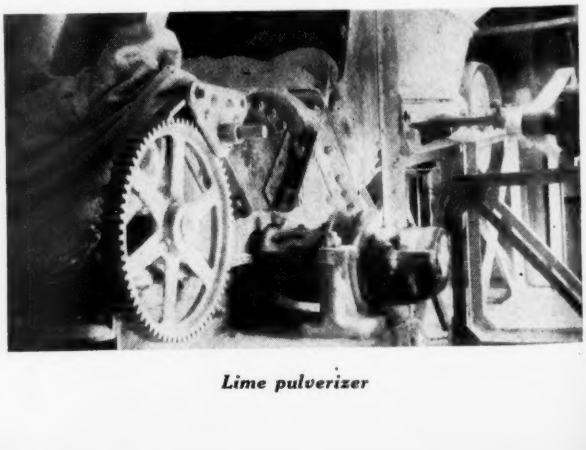
The discharge from the crusher falls on a 36 in.-conveyor belt. While this fall is small there have been indications of wear in the belt caused by the impact. The management intends to install some kind of baffle in order to limit the force of this impact. This conveyor belt elevates the rock to the top of the screening plant 90 ft. above the quarry floor, traveling about 350 ft. at an angle of 15 deg.

A triple-jacketed Allis-Chalmers rotating screen receives the crushed rock from the conveyor and separates it into seven macadam sizes for commercial sale and large size rock for the lime kilns.

Bins directly below the screen receive the various sizes of rock through steel chutes. From these the stone may be



Crushed rock going up to screen



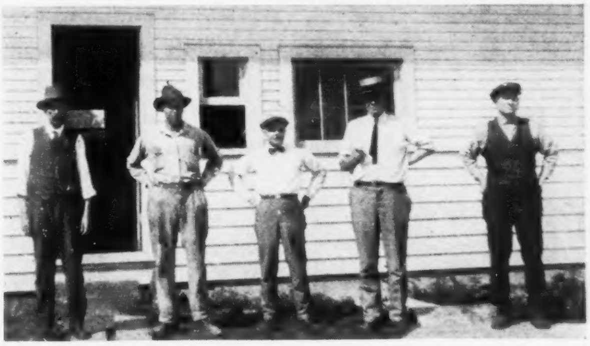
Lime pulverizer

drawn off into trucks for local jobs or cars for shipment.

There is also, to some extent, the general difficulty that plants manufacturing several sizes of stone for commercial purposes have in selling their output of these sizes uniformly with the manufacturer so the Herzogs store considerable quantities of the smaller sizes of stone. plant, the Herzogs also operate a lime plant, manufacturing agricultural and building lime. The plant consists of six kilns which are charged in the usual manner with material transported from the crushing plant or storage in front of the screening plant on cars elevated to the charging floor by a Lidgerwood hoist.

The coal is loaded into a hopper above conveyed to a lime storage silo with a capacity of eight cars. The lime is put on the cars by a Link-Belt loader.

Each unit in the plant is driven by an individual electric motor. Some power, about 75 kw., is purchased from the local electric power company and the rest is supplied by a 300 kv-a. General Electric generator driven through a jack-shaft by



At the left is the locomotive crane unloading cars to storage, and the staff, reading left to right, is composed of Fred Cramer, bookkeeper; William Wentz, superintendent; J. W. Tilley, salesman; Bert Herzog, manager; William Johnson, operating engineer

The excess of any size is drawn from the bins into cars which are run to storage piles and unloaded by an Ohio locomotive crane equipped with a Blaw-Knox dreadnaught clamshell.

The efficient operation of a crushing plant of this nature demands the storage of some sizes and Manager Bert Herzog claims that storage is economical as well with the use of the locomotive crane.

In conjunction with the rock crushing the kilns by the locomotive crane and is fed to the firing floor by gravity. The burnt clinker is unloaded from the kilns to cars and pushed by hand down an underground passage-way to the foot of a skip elevator which delivers it to a storage silo having a capacity of four cars, or about two days' output. A Webster shuffle feeder delivers the clinker to the Pennsylvania pulverizer from which it is elevated, screened and two Miller improved gas engines operating on natural gas from wells owned by the company.

Bert Herzog is manager of the firm, which is a partnership composed of John Herzog, the founder of the company, and his sons. The personnel of the operating staff is Fred Cramer, bookkeeper; William Wentz, superintendent; J. W. Tilley, salesman, and William Johnson, engineer.

Southern Nevada's Magnesite

A MASSIVE deposit of magnesite of unusual character recently brought to the attention of the United States Geological Survey promises to yield a large and readily available supply. The deposit lies in Clark county, Nevada, in the valley of Muddy river, a few miles above St. Thomas. The material has been known for some time as kaolin, and successful experiments for utilizing it as a porcelain clay are reported to have been made.

The so-called kaolin is stated by the Survey to be in fact a magnesite and was deposited in a highly magnesian sedimentary bed, a part of a regularly stratified series of sedimentary beds exposed by stream channels that cut across a low ridge at the upper edge of Muddy valley. The deposit forms a chalky-looking bluff, dazzlingly white in the bright sunlight.

The deposit is included between tilted beds of conglomerate and sandstone below and shale above. The lower contact is sharply defined, but the magnesite grades up into the overlying beds. The purer part of the deposit consists of beds aggregating at least 200 ft. in thickness. Within the section of purer material there are a few bands of sandy matter, but these are minor in amount and apparently almost negligible, as they could undoubtedly be avoided in mining.

The region is in large part covered with alluvial wash, which conceals most of the bedrock formations, so that the section including the magnesite is exposed at only a few places where streams have cut down through the overlying deposits. The regularity of the exposed section and the continuity of the harder beds, which project through the surface wash, justify the assumption that the magnesite is practically continuous between exposures and for considerable distances beyond. Its length at the surface seems to be a mile at least. Unlike most other deposits of magnesite in California and elsewhere in this country, this is not a vein deposit, such as occurs with serpentine, but resembles closely the deposits discovered in 1911 at Bissell siding, near Mohave, Calif., both being interbedded with sandstone and shale and of sedimentary origin.

Samples of this material were noticed in a mineral cabinet at Las Vegas, Nev., August, 1915, by a geologist of the Survey, who then recognized the material as probably magnesite, though he was informed that it was kaolin. Later he visited the deposit in company with one of the claimants and was then informed that analyses made in Salt Lake City showed that it was magnesite. So far as known, however, no special importance had been attached to this fact, as the material was then being exploited at the Panama-Pacific Exposition in San Francisco under the name of kaolin. The new deposits are so large and so readily accessible that they may form a valuable source of magnesite. The series of beds that contains the magnesite is the "Horse Spring formation," of Tertiary age.

The Coal Priority Order of the Interstate Commerce Commission

The full text shows cause to fear 1920 conditions will be repeated. Flat-bottom gondola cars with sides 36 inches or less are exempted—all other gondola cars are COAL CARS AGAIN. Reconsignment of coal is to be controlled. Effects of order on mineral aggregate industry after the mines begin operation, is awaited with much anxiety

WHAT will be the effect of the coal priority order of the Interstate Commerce Commission, issued July 25 and effective July 26, cannot be known until the coal miners' strike is ended and coal begins to move. Until then it is very doubtful if any plea for consideration by the mineral aggregate industries would be well timed or even considered. They would be answered by inference, if not in the exact words: "Wait till you are hurt before you 'holler'!"

However, it is difficult to see how the mineral aggregate industries can avoid being seriously handicapped at the very height of the season, and how other building material industries, such as cement, lime and gypsum, can avoid coal shortages which will seriously hinder their operation and cause them losses. Yet there seems nothing to do, at least at this time, but to grin and make the best of a very bad situation. It is hard to keep down one's ire, though, when it is considered that these industries must be compelled *again* to bear all the losses for a rotten economic condition in the coal industry.

Below is the text, complete, of Service Order No. 23 of the Interstate Commerce Commission, dated July 25, 1922:

Text of Interstate Commerce Commission Priority Order

"*It appearing,* In the opinion of the commission that an emergency which requires immediate action exists upon the lines of each and all the common carriers by railroad subject to the Interstate Commerce Act, east of the Mississippi river, including the west bank crossings thereof, and because of the inability of said common carriers properly and completely to serve the public in the transportation of essential commodities. *It is ordered and directed*

"1. That each such common carrier by railroad, to the extent that it is currently to be unable promptly to transport all freight traffic offered to it for movement, or to be moved over its line or lines of railway shall give preference and priority to the movement of each of the following commodities: Food for human consumption, feed for live stock, live stock, perishable products, coal, coke and fuel oil.

"2. That to the extent any such common carrier by railroad is unable under the existing interchange and car service rules, to return cars to its connections promptly, it shall give preference and priority in the movement, exchange, interchange and return of empty cars intended to be used for the transportation of the commodities specially designated in paragraph numbered 1 hereof.

"3. That any and all such common carriers by railroad which serve coal mines whether located upon the line or lines of any such railroad or customarily dependent upon it for car supply, herein termed coal-loading carriers, be, and they are hereby, authorized and directed whenever unable to supply all uses in full, to furnish such coal mines with open-top cars suitable for the loading and transportation of coal, in preference to any other use, supply, movement, distribution, exchange, interchange or return of such cars; *provided,* that the phrase "suitable for the loading and transportation of coal" as used in this order shall not include or embrace flat (fixed) bottom gondola cars with sides less than 36 inches in height, inside measurement, or cars equipped with racks, or cars which, on July 1, 1922, had been definitely retired from service for the transportation of coal and stenciled or tagged for other service.

"4. That all such common carriers by railroad other than coal-loading carriers, herein termed non-coal-loading carriers be, and they are hereby authorized and directed to deliver daily to a connecting coal-loading carrier or carriers, or to an intermediate non-coal-loading carrier for delivery through the usual channels to a coal-loading carrier, or carriers, empty coal cars up to the maximum ability of each such non-coal-loading carrier to make such deliveries and of each such connecting coal-loading carrier to receive and use the coal cars so delivered for the preferential purposes herein set forth.

"5. That all such common carriers by railroad be, and they are hereby, authorized and directed to discontinue the use of cars suitable for the loading and transportation of coal, for the transportation of commodities other than coal, so long as any coal mine remains to be served by it with such cars; and as to each non-coal-loading carrier, so long as deliveries of any such cars to connecting carries may be due or remain to be performed under the terms of this order.

"6. That all such common carriers by railroad be, and they are hereby, authorized and directed, to place an embargo against the receipt of coal or other freight transported in open-top cars suitable for coal loading, by any consignee, and against the placement of such open-top cars for consignment to any consignee, who shall fail or refuse to unload such coal or other freight so transported in coal cars and placed for unloading, within 24 hours after such placement, until all coal or other freight so transported in coal cars and so placed has been unloaded by such consignee and shall notify the commission of such action. This authorization and direction as to embargoes shall not interfere with the movement of coal to tidewater or the Great Lakes for transshipment to water, nor shall it apply where the failure of the consignee to unload is due directly to errors or disabilities of the railroad in delivering cars.

"7. That in the supply of cars to mines upon the lines of any coal-loading carrier, such carrier is hereby authorized and directed, to place, furnish, and assign such coal mines with cars suitable for the loading and transportation of coal in succession as may be required for the following classes of purposes, and in following order of classes, namely:

"*CLASS 1.* For such special purposes as may from time to time be specially designed by the Commissioner, its agent therefor. And subject thereto:

"*CLASS 2.* (a) For fuel for railroads and other common carriers, and for bunkering ships and vessels; (b) for public utilities which directly serve the general public under a franchise therefor, with street and interurban railways, electric power and light, gas, water and sewer

works; ice plants which directly serve the public generally with ice, or supply refrigeration for human food stuffs; hospitals; (c) for the United States, state, county, or municipal governments, and for their hospitals, schools, and for their other public institutions—all to the end that such common carriers, public utilities, quasi public utilities, and governments may be kept supplied with coal for current use for such purposes, but not for storage, exchange, or sale. And subject thereto:

"*CLASS 3.* (As to each coal-loading carrier which reaches mines in Pennsylvania, Ohio, West Virginia, Kentucky, Tennessee and Alabama.) For bituminous coal consigned to any Lake Erie port for transshipment by water to ports upon Lake Superior. And subject thereto:

"*CLASS 4.* (As to all such common carriers by railroad.) Commercial sizes of coal for domestic use. And subject thereto:

"*CLASS 5.* Other purposes.

No coal embraced in Classes 1, 2, 3 or 4 shall be subject to reconsignment or diversion except for some purpose in the same class or a superior class in the order of priority herein prescribed.

"8. That all rules, regulations and practices of said common carriers by railroad with respect to car service as that term is defined in said act are hereby suspended so far as they conflict with the directions hereby made.

"9. That this order shall be effective from and after July 26, 1922, and shall remain in force until the further order of the Commission.

"10. That copies of this order be served upon the carriers hereinbefore described, and that notice of this order be given to the general public by depositing a copy hereof in the office of the secretary of the Commission at Washington, D. C."

Manufacture of Magnesium Oxychloride Cement

Salient points based on recent tests of plastic calcined magnesite. Properties of magnesium oxide vary with different conditions of burning

THE MAGNESIUM OXYCHLORIDE INDUSTRY dates from the discovery by Sorel, in 1867, of the cementing action of a mixture of magnesium oxide and a solution of magnesium chloride. Sorel found that the cement produced was enormously strong and had very high binding power, that is, that it would allow of dilution with a very large quantity of aggregate and still produce a product of high strength. It was particularly noted that it would bind sawdust in satisfactory fashion to a hard, tough mass. This could not be accomplished by any of the usual cementing mediums known at that time.

The exact chemical constitution of Sorel's cement is still an open question. It seems probable that it is only partly a definite oxychloride, probably $3MgO.MgCl_2 10 H_2O$, and that this is mixed with solid solutions of indefinite composition. Efforts to regulate the ratio of a mix in such fashion as to keep the oxide-chloride ratio constant at that which holds for some particular oxychloride have not been reflected by any striking results from a strength or soundness standpoint.

The commercial possibilities of Sorel's cement were very soon recognized and within a comparatively few years after his invention the construction of floors composed of sawdust, wood flour and sometimes silicious aggregate, cemented with magnesium oxychloride, became quite common in Germany and in France. Various difficulties in the preparation of satisfactory mixes were experienced, but the industry developed normally and later spread to this country. It is found possible to secure properties in a flooring using an oxychloride cement binder which cannot be obtained by the use of any other flooring material. The product, accordingly, has taken its place as a more or less standard building material.

Oxychloride, or, as they are commonly called, "composition" floorings require require highly skilled workmanship in their application, but numerous organizations are now in a position to lay such floors. The development of exterior stuccos in which magnesium oxychloride is the binding medium is more recent. Sorel's original statements as to the waterproofness of his cement have not been entirely confirmed and there was for a long time a real doubt as to the permanence of such stuccos. Experience has shown, however, that, provided the raw materials are of proper quality and are properly mixed, a sound and permanent stucco will result.

Ingredients of Oxychloride Cements

In the preparation of any oxychloride cement, three classes of raw materials are required; aggregates, magnesium chloride, and magnesium oxide. The aggregates employed include sand, ground silica or silex, marble or limestone dust, talc, china clay, sawdust and wood flours of various grades, asbestos fiber, and pulverized cork. The fineness and the percentage of voids in the sand, the fineness of the various fine fillers, the type of wood and the particle size of wood flours and sawdust, the fiber length of asbestos, and the fineness of granulated cork give indications as to their value. The magnesium chloride employed is recovered from natural brines or salts in the Stassfurt district, or from Michigan, Utah, or California in this country.

The usual product is either a solid or granular material containing in the neighborhood of 98 per cent $MgCl_2 6 H_2O$ and less than two per cent of calcium chloride, of magnesium sulfate, or of sodium chloride. Chemical analysis clearly indicates its quality. The magnesium oxide required is essentially all prepared from natural magnesite, large deposits of which occur in Greece, Austria, Venezuela, and in the states of Nevada, Washington, and California.

The strength of the magnesium chloride solution has great influence on the properties of oxychloride cement. Satisfactory results cannot be expected from dilute chloride solutions.

With chloride solution strengths above 24 degrees Baume, undue expansion effects develop. The optimum concentration of the magnesium chloride solution appears to lie at 22 degrees Baume. A certain amount of field work is done with chloride solutions of from 18 degrees to 20 degrees Baume, but the slight saving in magnesium chloride effected by this practice cannot be justified in view of the decided advantage to be gained by the use of somewhat stronger chloride. The reason for the use of weak chloride is frequently said to be the fact that such chloride solutions will make an oxychlor-

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Based on a paper by Max Y. Seaton, read at the 1921 convention of the American Society for Testing Materials, entitled: 'Testing of Plastic Calcined Magnesite for Use in Oxychloride Cements.'"

ide cement which sets slower. This is entirely opposed to the results found from determination of setting time of a series of mixes in which chloride strength is varied.

From the practical man's standpoint setting time of an oxychloride stucco is of interest inasmuch as it influences the behavior of the stucco when dry pebble dash is applied to it. A material which sets too fast resists the penetration of the pebbles. Careful tests have shown that although there is a slight difference in favor of a stucco prepared with weak chloride when the question of dash penetration is considered, this difference is only in the neighborhood of 10 per cent, an amount which is not observable in actual practice. Observations of the application of oxychloride stucco in the field definitely confirm this statement.

Effect of Aggregates

The character of the aggregate influences the various properties of an oxychloride cement in a rather complex way, and the question can no more be covered in a short space than can that of the study of aggregates for use in portland cement concretes. In general, it may be said that the use of fine aggregate is essential for the attainment of high strengths and good water resistance. The mechanism of the setting reaction with oxychloride cement is quite different than with portland cement. When portland cement sets, the small particles surround themselves with a shell of reaction product but the center of each cement particle remains unchanged. In a sense, then, portland cement furnishes its own fine aggregate.

With oxychloride cements, provided the calcined magnesite is reasonably finely ground, each particle of magnesium oxide completely enters into reaction. If the reaction product is called on to fill the comparatively large voids between sand grains, a mass of inferior strength will result. However, if a fine aggregate is introduced which will itself enter the voids between sand grains, the oxychloride cement will need only to coat these particles of fine aggregate and to fill the much smaller voids which would result and much higher strengths and permanence will be secured. Here, as in the case of portland cement mortars or concretes, the cementing material is the weakest portion of the set mass and if it can be reduced to a minimum, the physical properties resulting will be more desirable.

When very finely ground magnesite is employed, the amount required for production of strong cements can be reduced to a surprisingly low figure, four or five per cent only being required in a mixture in which the coarsest aggregate is a comparatively fine sand. If an oxychloride concrete were to be formed, the amount needed would be still smaller. Mixes without fine aggregate often disintegrate completely on wetting.

Quality of Magnesite

The quality of commercial calcined magnesite exerts a tremendous influence on the properties of oxychloride cements. Certain magnesites appear on the market which will not give a satisfactory product no matter what attention be paid to other details of mix composition. The usual tests of magnesite quality which have been applied in the past have consisted of a chemical analysis of the calcined product. In general, limits for ignition loss, calcium oxide, silica and magnesium oxide have been written into specifications. Users of this product have come to realize during the past few years, however, that their chemical analysis specifications were not insuring them a magnesite of high quality.

Study of several hundred commercial magnesites has indicated that there is only one factor determinable by chemical test which exerts a definite influence on the character of the cement. This is the percentage of active lime; that is, the amount of calcium oxide, hydroxide, or basic carbonate which will react with magnesium chloride solution with the liberation of calcium chloride. The amount of this constituent present bears no relation to the content of total lime in the magnesium oxide. Active lime can be determined by agitation with dilute magnesium chloride solution and determination of the amount of calcium chloride introduced into the solution. Unfortunately, it is found that the relation between strength, permanency and active lime content is only traceable when average figures covering many magnesites are examined. Other factors play so important a part in regulating oxychloride cement strength that the relation does not appear when test results on individual samples are examined.

The explanation of the wide discrepancy between chemical analysis and physical test results is found in the fact that the time-temperature history of the calcining procedure is of vital influence on the reaction between magnesium oxide and magnesium chloride, although it is not reflected in any major change in analysis. Widely varying results can be secured from samples of calcined magnesite prepared from the same natural rock burned until essentially all the gas is removed, and accordingly having approximately the same composition.

Suggested Specifications

Fairly satisfactory results can be obtained in study of magnesite quality if reliance be placed on purely physical tests. A determination of fineness is unquestionably of value. At least 97 per cent of the material should pass a 100-mesh screen and at least 75 per cent a 200-mesh screen. Calcined magnesite is a comparatively easy material to grind and it is very probable that this fineness can be greatly increased and quality accordingly improved without introducing serious manufacturing difficulties. Coarse magnesite results in abnormal expansion of the cements prepared from it. The magnesite, if of satisfactory fineness, should be used in a standard oxychloride mix, preferably the one magnesite, two silex, five sand composition. The specific gravity of the chloride solution used should be 22 degrees Baume.

The plastic oxychloride mortar should not show initial set within an hour. It should attain final set within eight hours. A two-hour minimum for initial set is preferred by some workers while some will consider the eight-hour maximum for final set unduly long. The first limits, however, are about those met by average commercial calcined magnesite. Modulus of rupture on the flat bars previously described should be at least 550 lb. per sq. in. at one day and at least 1,000 lb. per sq. in. at seven days. Oxychloride cements from average magnesites will give figures much higher than these. Limits on expansion and contraction are exceedingly difficult to set but it is probable that a magnesite which shows over 0.3 per cent contraction or expansion within 24 hours after initial set in the mix specified should be considered as of questionable quality. Limits for water resistance are also hard to set. Unless the oxychloride cement made from a particular magnesite shows a wet strength after the standard spraying procedure of at least 30 per cent of its dry strength, however, some doubt as to magnesite quality should be felt.

A calcined magnesite which meets the requirements suggested will certainly be of at least average quality. Much better material than that indicated can be secured when greater attention to the preparation of the calcined product is given by the various producers. Co-operative work is now under way which should lead to the establishment of more definite limits for the various factors discussed, probably resulting in the issuance of definite specifications for plastic calcined magnesite within a year or so.

The oxychloride industry is one of remarkable latent possibilities. It has suffered seriously from lack of attention to the quality of the raw materials used and from lack of knowledge of the basic principles of mix preparation. As more data on both of these points become available, there is little question but that oxychloride cement products will take their place as standard construction materials for certain definite uses.

My Experiences with Rotary Kiln Lime Burning

When one lime manufacturer tells a group of other lime makers some of the things he has learned from experience, as Mr. Warner did at the recent National Lime Association convention, the result is a valuable contribution to lime literature. The following article treats every-day problems in an every-day manner:

By Irving Warner
Charles Warner Co. and American Lime and Stone Co.

THE problems of the rotary kiln in lime burning have many things in common with the rotary kiln in cement practice, but in addition we have had new problems with which the cement man has never had to deal. The work that the cement manufacturers have done in the past has been of great help to us in settling a good many of the physical problems, such as the structural strength of the kiln, the methods of dry burning, feeding devices, and so on. But on the other hand, as I have found it, new problems have arisen for which there is no precedent. So far as I know, there is nobody who can be called an expert in the manufacture of lime by the rotary kiln.

My own experience has naturally been confined to one kiln at Cedar Hollow, measuring 8x150 ft., together with what experience I have been able to accumulate by reading the articles in such magazines as ROCK PRODUCTS and others and by visiting other plants. And I have more or less come to a definite idea of what constitutes good practice in lime burning, although on account of certain conditions, I have not been able to follow my own advice.

One of the great difficulties we have had in this matter is the fact that the rotary lime kiln of reasonable size to secure efficiency makes a large production from the lime manufacturer's standpoint, with the result that, so far as I can recall for the moment, there is no lime manufacturer, as such, who has more than one kiln. There are quite a number of industries making lime for their own purposes, who have batteries of two, three, or even more kilns, where perhaps the operators have been enabled to work out their own practice, experimenting with one kiln and applying the good things they find to the other kilns. But so far the lime manufacturer has not been in that position. If he wants to do any experimenting, he has had to do it on his single unit. And after he has discovered something, he hasn't got a whole battery of kilns on which to apply the information. Therefore, he must be quite judicious in what he undertakes, because he can't afford to make very many failures in his experimental work.

We have not yet gotten down to standard

Few practical men have spent the time and energy that Irving Warner has in the study of lime burning in rotary kilns. For years connected with the Charles Warner Co., he is now general manager of the American Lime and Stone Co., and what he says here is both authoritative and practical.

practice. And when I say *we*, I am referring to all the lime manufacturers, because I still find a great diversity of opinion on some of the problems which might appear to be of the most simple nature. Take probably the most important question, that of source of fuel supply. Today there are in practice only two methods; one, the gas producer, which we have employed, and the other, pulverized coal. I can't think for the moment of any lime manufacturer who uses what might be called the orthodox coal pulverizing plant such as is used by the cement manufacturers—a separate plant in which the pulverization is very fine after the coal is dried. It is quite an operation in itself, and since the lime manufacturer has only single kiln units, the separate coal pulverizing plant has not in general been justified.

Coal or Gas for Fuel?

The result has been that the pulverized coal systems that have been used are the so-called self-contained units which pulverize and inject as one operation. I have not had any experience with units of this type, but apparently they are giving satisfaction in some plants. My own personal experience has been confined entirely to the gas producer.

Now, I have had two phases of experience with the gas producer which may be of interest. In our kiln, which is 6½ ft. inside diameter and 150 ft. long, we originally had two semi-mechanical producers which were capable of gasifying 36 tons of coal in 24 hours. But the charging of the coal on these was done by hand intermittently, and the gas was not as uniform as it should be. We had that sort of operation for two or three years. We are gradually improving our practice, getting up our kiln from around the high eighties in tons a day up to nineties, and sometimes we have a full week's run of well over 100 tons a day.

Then, at the time we built a Mount kiln, we installed also a Morgan producer which helps supply fuel to the rotary kiln, and thereafter, we obtained much better results.

Unfortunately, the year 1921 was so dull that we could not carry on our experimental work as we would like to have done. And I cannot give any figures that satisfy myself as to their accuracy regarding the

improved results due to this all-mechanical producer which we have tried in this kiln. But the results are very pronounced, and show that it came up from 2.75 lb. of lime per pound of coal to well above 3. Capacities on the kiln have been maintained at much better rates, also.

Repeatedly, we have had weekly records that averaged better than 110 tons per day. This indicates the advantage of having a sufficient quantity of uniform, mechanically produced gas in rotary boiler practice.

So far as the self-contained pulverizing system is concerned, I am so well satisfied as to the excellence of these systems that we expect to install one of them ourselves.

At the time we installed our rotary kiln, the prevailing method of firing where lime was used as a marketable product was with gas fire. Though we felt that pulverized coal was the proper process for firing, we had to install in our plant methods of which we felt sure. We had to get definite results, and we couldn't afford to take a chance. That is why our plant went in with gas fuel in the first place.

What Size of Stone Burns Best?

Another point of difference is the question of sizing the store. Our own practice is to pass the stone through a rotary screen which retains the material on a ⅝-in. screen and passes 1¼-in. Other users insist that the larger size stone burns better, say, from 1 to 2 in. This is positively not our experience. The fact is that under certain operating conditions, when we had a surplus of these screenings passing the ⅝-in. screen, we have by dryer and screen device recovered some of this ¼-in. stone running, let's say, from 3/16 to ⅝-in., and sent this stone back to the kiln. It certainly produced lime at a very rapid rate. It is our experience that kilns do like small stone. And it is purely a practical operating condition that it is impracticable to reduce all the stone to these small sizes without making such an excessive percentage of fines as to defeat the very purpose of the rotary kiln as the worker-up of a byproduct. So as a compromise, we consider that ⅝-in. to 1¼-in. stone is very satisfactory.

Now there is an interesting phase of this question of sizing stone which should be spoken of right here, and that is, which size of stone in the kiln is the one that shows core? I have had two men with engineering qualifications who have worked on the same plant give me a flatly opposite story. One has said that the core that comes from the kiln is in the finer stone. And the other has said that it is in the center of the larger pieces. Both of these were experienced men and both were working on the same plant.

I think I know the answer to it, though I have never been able to try it out in practice. I will submit the theory from my own knowledge of plant operations. It is known, for example, that in a rotary screen, if there is too much of a load on the screen, the fines will not screen out; they circulate in the center of the mass. That is a well-known fact. Now that is what can happen in a rotary kiln under certain conditions. If the variation in size is too great between finer and coarser material and the load is heavy, then there will be a condition in which the fines constantly circulate in the center of the mass and come out as core.

Any rotary kiln, according to cement engineers, burns in two general ways: First, by the actual radiating effect of the flame on the surface; and the other due to the heating of the brick lining which subsequently passes underneath the mass of material and returns its heat to that mass. The fine material circulating in the center never gets in contact with the heat, and presumably can come out as core. I have never proved it in actual operation to my own satisfaction, but I consider it a very good theory.

On the other hand, if the variation in sizes between maximum and minimum is not so great, and perhaps the kiln is run with a thinner load and a little too rapidly for the amount of heat being given to it, then the core will be at the center of the big pieces.

If this theory is correct, any operator can work to a point where, on the one hand, he will be able to avoid unburnt fines resulting from overloading or, on the other hand, avoid core in the larger pieces through overspeeding with insufficient heat. In our own experience, we have only suffered from the latter condition, but with proper equipment and sufficient fuel it can always be easily controlled.

Kiln Loading and Speeds

I mentioned the question of loading. That means the depth of the segment of material in cross-section of the kiln. Operating men are very prone to run a thin load, and yet it can be shown mathematically that a certain depth must be carried to obtain any required capacity from the kiln. In the early days of our experimenting we had a load which gave us only 60 tons a day with a given kiln speed. It was about as fast as we could drive the kiln to burn thoroughly. I simply said to the operating man that we would run a heavier load. There was no other way of getting the production from the kiln. I usually like to have them work out their own problems, but here was a case where I simply had to force what I knew was correct practice on them.

There are various systems for varying the speed of the kiln and maintaining the relationship between the feeding device and the kiln itself. But in my opinion there is only one that is proper and that has largely been adopted by the cement manufacturers. The ratio of speed between the feeding device and the kiln should always be constant. Now, of course, there must be means of variation in order to find what that proper ratio is. But in the course of time it is determined what that proper ratio is, and that gives a definite loading upon the kiln at all times. Regardless of changing conditions in the kiln, brought about by atmospheric variations or through the supply of fuel, that ratio should not be changed. The depth of the load on the kiln should always be kept constant. But in order to secure proper burning or to prevent overburning, control is secured by the speed of the kiln itself.

In our own practice, we simply use a variable speed electric motor. And since we have alternating current, we naturally don't have a motor too large for the job, or otherwise it wouldn't slow down. The control, of course, is placed at the firing end of the kiln where the operator can readily change the speed by small steps as he sees fit, because it is very necessary that that speed be kept right. And it is always easy to keep it right with the least practical experience on the part of a reasonably intelligent worker. If he does not drive his kiln fast enough, fluxing action will soon begin to take place because it becomes like a boiler without water. The temperature rises at a terrific rate if he is not constantly sending the coal material against the fire rapidly enough to keep it sufficiently cool. I say sufficiently cool in a comparative way. If a man slows up a kiln and tries to get it too hot he will soon get into trouble. It works that way particularly with dolomitic lime. I don't know how that will work out with high calcium lime, because dolomitic lime is much more susceptible to fluxing and sticking than high calcium stone.

Question of Hand Operation

Let me add a little question of good operation at this point which it is well to note. As many of you know that have dealt with any rotary machines such as a kiln or a drier, the control of the travel of the kiln up or down is taken care of by a slight angular cutting of the supporting wheels. The changing of the angularity of those supporting wheels is always done at the upper end of the kiln where the temperatures are lower. That is a practical proposition.

It is a long way from the firing end of the kiln up to the upper end where that work is done. We put an ammeter on our motor down at the firing end so that the operator could see what he was doing. But when the change of angularity of the roll was done, in order to take care of the up-and-down travel of the kiln, we found that our horsepower consumption was mounting rapidly and a call quickly came in for a

bigger motor. So we installed a second ammeter right where the operator could see it when he was changing the angularity of his rollers. In that way we cut the horsepower down by about 10 h.p., and of course that meant that we were saving that much on the wear and tear of the kiln, because what the operator was actually doing was setting one roller against the other, and the net difference was the travel that he wished to secure; whereas, as soon as we put the ammeter in he always worked with one that reduced the horsepower instead of increasing it. The men get on to that with remarkable rapidity. Even foreign workers, after a little instruction, can do it themselves very readily.

Our rule now is to place an ammeter in a case like that where the man can see it no matter on which side of the kiln he is working. When an operator is working one of these large wrenches that weigh about 150 lb. and measure 5 to 6 ft. long unless the ammeter is where it is easy for him to see, he is not going to drop his wrench and look around the corner. It has got to be where he can hold on to the wrench, do his work and see the ammeter at the same time, and the instrument must be visible from both sides of the kiln.

The Best Kiln Inclination

Now about the inclination of a kiln. Cement practice is largely ½-in. to the foot—sometimes less. We put our kiln at ¾-in. to the foot. Although I don't think it is a matter of great moment, I think we would be a little better off if it had been down to ⅝ or even ½ in. Here is the effect of inclination: Naturally the travel of the material in the kiln is greater for each revolution when a kiln is placed steeper. Therefore, we cannot revolve our kiln as rapidly as a man who has set his kiln at only ½ in. to the foot, even assuming that we are running the same loading.

Naturally it is good practice to make the loading as heavy as possible and still secure good burning. So when the kiln is too steep, we cannot get the frequent agitation, the transfer of heat between the lining and the material, that the man can who runs at a slightly smaller angle. I believe about ½ in., or certainly not more than ⅝ in., would be good practice for the future.

Now concerning heat recovery. I made some rather superficial figures on that matter and I came to the conclusion that the lime manufacturer with one kiln, say, 8 or 9 ft. in diameter and 150 to 175 ft. long, cannot afford to put in a heat recovery system. The interest on investment, the depreciation charges, the men that are necessary to take care of it, the possibilities of paying breakdown service to the electric company or maintaining a separate boiler, or separately firing the same boiler, practically eat up any saving obtainable. It takes only slightly more investment and practically no more attendance to make an installation for two kilns. Two larger kilns would apparently pay for the waste heat recovery system. But those of you who have only one kiln and look longingly at these gas temperatures going out at 1200 to 1300 deg., might as well ignore it, because it won't pay you.

Dusting in a Rotary Kiln

There is something mysterious about a rotary kiln on lime which I have never been able to find out. That is, it is necessary to use a higher percentage of stone by weight than the finished lime represents and that weight is used even if the stack gas seems to be entirely clear and the stone itself is good clean stone. I have made a number of tests on our kiln of the weight of material going in and the weight of material coming out. I could find no relationship between the loss in weight and the dirty condition of the stone. I have made that test with clean stone; and I have made it with dirty stone. If anything was true, the dirty stone suffered less loss than the clean stone, and yet the stack of the kiln when using dirty stone was obviously more dusty.

There is a practical phase of this dusting problem with which we can deal. The cement manufacturer, if he is having his material properly made, is actually fluxing the clinker and making a more or less dustless product. He can start with a dusting material and lose some of that material in the upper end of his kiln. But if he is burning his clinker good and hard, he is making a practically dustless product at the discharge end.

The lime manufacturer's problem is just the reverse. He may start with a good clean stone, hard, free of dust, and as it begins to turn to lime at the surface, abrasion takes place which constantly produces dust. Therefore, the greatest care must be used in the handling of lime that comes out from the discharge end of the kiln, and, subsequent to that point, to see that it is not caught by air currents that will pick up this dust and carry it back to the kiln. Any dusting action is detrimental to any flame, no matter whether it is gas or pulverized coal.

Quadrant Partition Plates

Now it is part of good practice to put a rotary cooler under the kiln for the purpose of securing that heat recovery. A rotary cooler may be a troublesome piece of apparatus, because the heat of the lime will often make the metal warp and cause conditions whereby dust which will be picked up by the current of air and carried right back to the kiln. Any lifting irons, such as Z-bars, which pick up the material so as to drop it through the air, are simply worse than useless. They let the material drop through the current of air and all the dust is picked out and sent back to the kiln and the flame is quenched.

We have developed satisfactory practice in that respect by installing what we call the quadrant partition plates. These are plates that are longitudinal with the axis of the cooler and divide the cooler into four quadrants. The lime passes into these four quadrants and in that way is divided into smaller masses and gets more contact with metal and cools quite rapidly.

Cooler manufacturers, in order to prevent the disruption of their machinery when it becomes heated, will make these quadrant plates with clearance spaces. From their point of view it is entirely proper, because naturally the interior quadrant plates reach a higher temperature than does the shell, and if they are firmly riveted together their expansion will simply rip the shells to pieces. So as a matter of self-protection they leave these expansion spaces. Yet to the lime manufacturer using that cooler it is quite fatal, because the dust drops through these slots and is carried back into the kiln.

Therefore, in specifying a cooler, any expansion joints of this kind must have butt straps properly provided to compensate for the expansion, but made sufficiently tight to absolutely prevent the passage through of the fine dust; because, as soon as the fine dust begins to sift through any small openings, it is going to be picked up and thus hurt the action of the kiln. And down at the discharge end where the materail falls off the quadrant plates, we have angle irons so that it can't fall off the end of the quadrant plate but must slide off the shell.

Points of Greatest Danger

When the lime drops from the kiln to the cooler, and again when it drops off the end of the cooler, are points where there is the greatest danger of the inrushing air picking up the dust. At such points, the greatest amount of care must be used in working out details which keep the air deflected from the flow of lime so far as possible.

There are still many problems to be solved in the economical production of lime by the rotary kiln. It is to be hoped that a more general interchange of experiences and knowledge of the subject will in the future put the rotary kiln where it rightfully belongs in our industry, namely, a high capacity and efficient producer of burnt lime.

Hoover to Speak at Chemical Industries Exposition

AMONG those who have consented to speak at the National Exposition of Chemical Industries, to be held in the Grand Central Palace, New York, September 11 to 16, is the Secretary of Commerce, Herbert Hoover. Mr. Hoover will address the Salesmen's Association of the American Chemical Industry, whose annual convention will be held in conjunction with the exposition.

Putting New Jersey's Potash Marls on a Paying Basis

The early history and some of the present commercial and engineering aspects of developing the New Jersey marls have been treated in the first two articles of this series. In this third and last article the author describes typical plants of each of the three classes of marl and potash extraction plants

By John H. Ruckman
Consulting Geologist and Engineer

IN spite of the severe conditions imposed by heavy freight rates and foreign competition, a number of New Jersey quarries and plants for marl and potash extraction are in operation, or in process of construction. These enterprises vary greatly in magniture, in method of operation and in the nature of the finished product. There are, however, three general classes into which most of the quarries and plants fall, namely, small pits frequently operated in connection with the owner's farm and representing little invested capital; quarries operated by machine with facilities for drying and classifying the product and representing an investment of from $50,000 to $100,000; potash extraction plants representing investments of much larger amounts. Few of the latter are today complete and none so far as the writer is aware has yet achieved production on a commercial scale.

A TYPICAL OPERATION OF MEDIUM SIZE

The smallest operations consist of hand-worked pits. This plant of the American Potash-Marl Company is typical of the medium-sized operations, which represent a considerable investment. This plant is designed chiefly to produce material suitable for fertilizer and water purification. The interior view is taken from the top of the storage bins and shows the gas engine at the left with the drier to the right

A Typical Small Pit

Numerous examples might be cited of each of the three classes, but to avoid repetition one plant of each type will be described, the examples being chosen chiefly with the idea of presenting those most typical and successful.

The small pits are invariably operated by hand, and ship the marl undried and unclassified as to size of grain. Their customers are sometimes neighboring farmers, but some of these small quarries have recently undertaken contracts of considerable size; one at least is shipping in carload lots as far as Chicago. A typical layout is the pit of William T. Hoffman, which is located about ½ mile northeast of the railway station of Birmingham, N. J. The pit has been operated for many years and between 500,000 and 800,000 tons of marl have been excavated and a much larger amount is still in sight. As in most of the successful small pits the geologic conditions are especially favorable. There is no overburden except about 9 ft. of leached-out, and hence worthless, marl. The marl itself is close grained and nearly free from water.

The method of operation is most conservative, differing but little from that used in the same pit 40 years ago. The depression left by the worked-out section of the quarry is approximately 400 yd. in length by 150 yd. in width. Across the face of the depression at one end there is a trench which has been developed by sinking a series of rectangular pits, each about 15 ft. long by 12 ft. wide and 15 ft. deep. Into these pits the overburden is shoveled while a new series of pits is opened on the shelf thus cleared. The usual crew consists of eight men and a horse; it takes them an average of three days to strip the necessary overburden and sink a pit through the marl. The excavations are kept clear of water by a small gasoline driven pump and the spoil is hoisted out by a bucket rigged to a derrick boom and operated by the horse. The marl is dumped into wagons which haul it to the nearby railway siding. The whole arrangement is about as simple as can be imagined and has all the advantages and disadvantages of a small enterprise. It will be noted that the invested capital is limited to the price of the land, the pump, and the derrick. There is no sales force to be maintained, no charges for offices or any overhead expenses whatever, except taxes. There is practically no way in which the operation of such a pit can be a loss to the owner since he need only operate under favorable market conditions. It is difficult to imagine a pit of this kind ever becoming a source of great profit; on the other hand at present market prices such pits should be a source of handsome revenue to their owners.

The Second Class of Operations

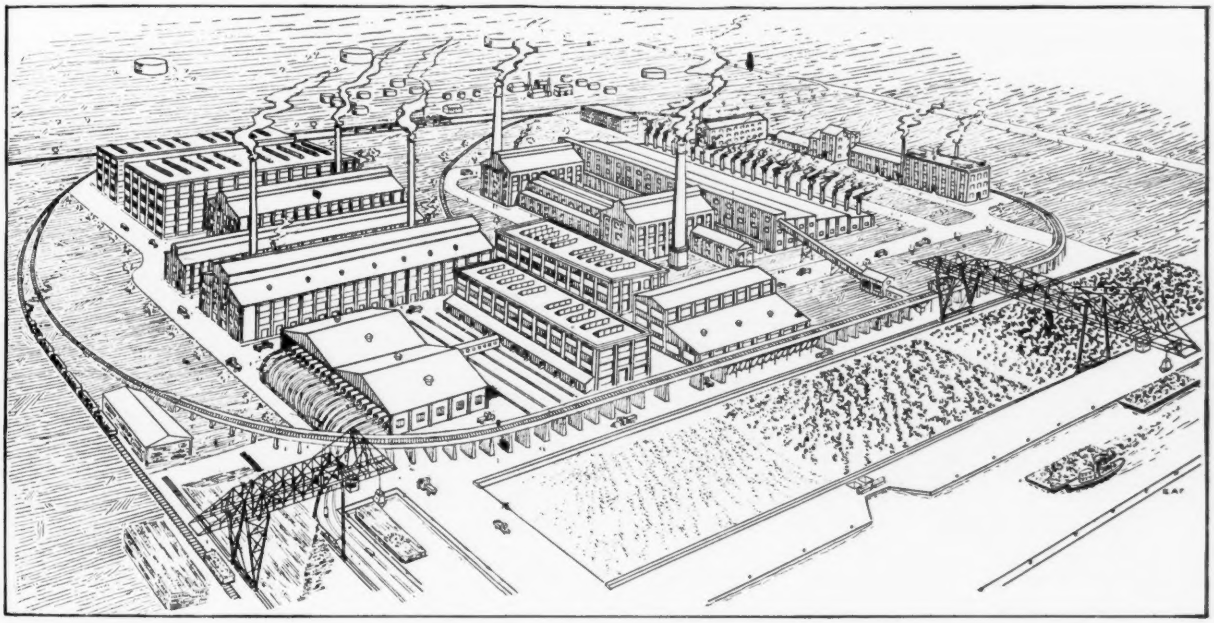
The second class includes plants which are considerably more pretentious. Some attempt is made not only to excavate the marl but to improve its marketability by drying and screening, or classification as to size of grain by hydraulic or pneumatic methods. Much could be done toward improving the potash content by magnetic treatment which would separate the glauconite from the impurities present at a very low cost. So far as is known, however, no plant has, as yet, made use of this method. Perhaps the most typical plant of this type and one of the most successful is that of the American Potash-Marl Co. located at Marlton, N. J., on the Pennsylvania railroad about one mile northeast of the town. The site for the pit in this case was chosen with great care, a large number of test borings being sunk to verify the excellent reports of the locality which had been published by the United States Geological Survey. The marl here forms a practically continuous bed over 50 ft. thick with an average potash content of nearly 6.5 per cent. The country is flat and rather poorly drained and the marl is open grained and carries artesian water; it is capped by about 12 ft. of limestone, made up of fossil shells, which has given a good deal of trouble. Most of the marl excavated at this point is of the globular type quite free from clay and has found a good market for water treatment. The plant is largely designed to produce material suitable for that purpose.

At the present time the main structure is a building with approximately 4000 sq. ft. of floor space, housing the drier and screens and providing some storage space. Power is supplied by a 35-hp. De La Vergne oil engine driving a main countershaft. A two-cylinder Ingersoll-Rand compressor, driven from this shaft, supplies air for an air-lift which operates in a nearby well. Water brought up by the lift carries a heavy burden of marl which is discharged into a pit where it settles on and is removed by a conveyor, which lifts the wet material to the hopper of a rotary drier. After passing through the drier the marl is elevated to another hopper, from which it falls through screens into storage bins. From these it is drawn as needed and packed in 150-lb. bags for shipment. Before the installation of the air-lift it had been customary to separate the finer material from the coarser by air blast. This treatment is no longer necessary since most of the finer material is washed out during the process of pumping. The product from this plant is sold at excellent prices, both for water treatment filter plants and in competition with ready mixed fertilizers throughout the East, many shipments having gone to New England.

Plants of this type receive a much higher price for their product than do the small pits which excavate and sell the crude marl only. Upon the other hand they have much heavier overhead and sales costs, the interest and depreciation charges are higher, and the element of risk enters to a much greater degree. It is not surprising, therefore, to find that while some are enjoying great prosperity, others which have not been so well managed or which lacked the necessary working capital to carry their fixed charges until they could establish a market have been obliged to suspend.

A Large Extraction Plant

The third class of enterprises includes those concerns which have undertaken to extract the potash in the glauconite marl by transforming it into soluble compounds. Practically all of them undertook this work during the war at a time when potash (K_2O) was worth approximately $700 a ton. The processes used, as we have seen, were numerous; the engineering and business ability displayed also varied greatly, but none of the companies which undertook this work has been as yet successful in placing the extraction of the potash from the marl on a really commercial basis. By far the largest of these enterprises and perhaps that which gives the greatest promise of ultimate success is the Eastern Potash Corporation of New York. This company was incorporated in August, 1918, under the laws of Delaware, with authorized capitalization of $7,5000,000 ($5,000,000 common and $2,500,000 preferred) for the purpose of applying the Charlton-Meadows process, which was described in the July 15 issue of Rock Products, to the extraction of potash from greensand marl and the manufacture and marketing of various byproducts. An experimental plant was established at Jones Point, N. Y., and the process was given a



Courtesy of Mr. R. Norris Shreve and *Chemical Age.*

Here is the layout of the plant of the Eastern Potash Corporation on the Raritan river near New Brunswick, N. J., where it is planned to extract potash from the greensand marls. At present it is only proposed to construct one-half of the plant as here shown

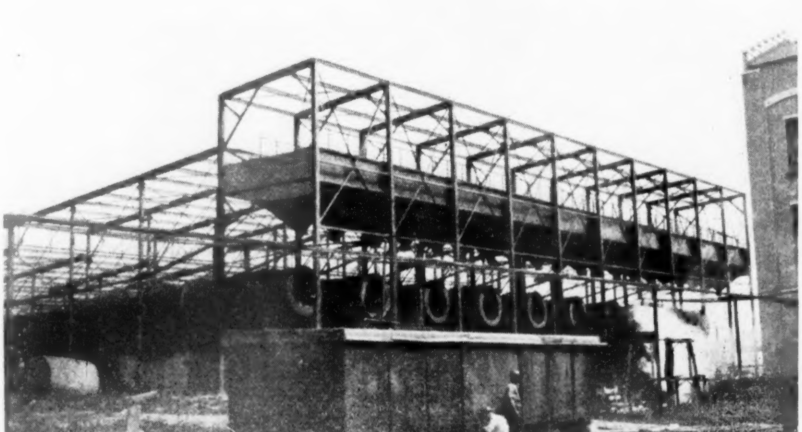
trial on a semi-commercial scale. The original process developed by Messrs. Charlton and Meadows was greatly improved and considerable information relative to the action of lime on glauconite at high pressures and temperatures was obtained, some of which has since been published by the chemical director of the company, R. Norris Shreve, to whom the writer is largely indebted for his information regarding the company. With the data thus gained as a basis plans were drawn up for a plant of very large capacity, and shortly afterward work was commenced.

Here is the partially completed Raritan river plant of the Eastern Potash Corporation

The plant is designed to treat 1000 tons of greensand a day, producing something over 75 tons of commercial potassium hydroxide (caustic potash, 90 per cent KOH.) Its original estimated cost was $2,000,000 but it is said that when completed this figure will have been considerably exceeded. The very immensity of the enterprise has proved somewhat of a drawback since it was impossible to complete the work during the era of high potash prices prevailing during and after the war. This seems most unfortunate since at the prices then existing the enterprise should have operated at a handsome profit and the production planned would have been a great aid to the munition industry.

The site selected is near the town of New Brunswick, N. J. With the topping plant of its subsidiary, the Raritan Refining Company, the works cover a property of something over a hundred acres located on a hillside which slopes gently to the Raritan river. In addition to the storage tanks, stills and pumping stations of the refining company, the plant as planned will include some 13 brick and steel buildings, housing the extraction plant and in addition a by-product brick establishment of 500,000 daily capacity, power plant, pump house, and machine shop. The brick used in construction is the product from the experimental plant at Jones Point. It is light gray in color and gives the buildings an attractive appearance. Provision has been made to allow duplication of the entire plant should increased capacity prove advisable. By the Raritan river and Raritan Bay direct water communication is provided to New York, while the Delaware and Raritan and Delaware and Chesapeake canals provide inland water communication to Philadelphia, Baltimore, and Norfolk. The three principal raw materials are greensand, limestone and fuel oil. Greensand is to be obtained from the Hornerstown formation at the company's quarry near Monmouth Park, N. J., where the bed is about 20 ft. thick, and is reported to average better than 7 per cent potash; it can be shipped to New Brunswick from this point either by water or by rail. Limestone is to be quarried at the company's property at McAffee, N. J. The rock is a crystalline formation of Pre-Cambrian age and is reported to average 95 per cent calcium carbonate; the chief impurity is mangesium carbonate, but it is reported that this gives no trouble in the process contemplated. The limestone is to be crushed in 1-in. size and shipped in that form to the Raritan plant, where it is to be burned.

By shipping crude limestone a considerable freight charge is incurred on worthless material since 40 per cent of the stone is carbon dioxide. This extra charge is largely offset by the lower freight rate as compared with quick lime and the utilization of waste heat from the lime kilns for generating power and evaporating water in the main plant. Furthermore, the shipment and storage of the immense quantities of quick lime necessary would prove impossible except by methods so expensive as to be out of the question. A further advantage gained by placing the lime kilns at the main plant is to be found in the relation existing between the Eastern Potash Company and the Raritan Refining Company. The latter organization, of which the entire capital stock is owned by the Eastern Potash Company, receives crude oil direct from Mexico; this oil it distills, marketing the lighter fractions. It is thus in a position to furnish the parent company with fuel in the form of residuum on every advantageous terms. As the improved Charlton-Meadows process demands the evaporation of very large quantities of water, inexpensive fuel is a matter of great importance. The daily charge for the plant is estimated at 1000 tons of greensand, 900 tons of lime (equivalent to 1700 tons of limestone) and 5100 tons of water. The day's expenditure of fuel should be in the neighborhood of 2300 bbl. of fuel oil or an equivalent amount of residuum.



This battery of ten 8x125-ft. rotary lime kilns at the plant of the Eastern Potash Corporation is the largest installation of its kind in the world. To the right can be seen the power house in which the waste gasses from the kilns will be used to generate them

A Battery of 10 Rotary Kilns

The crushed limestone will be brought from the quarry by rail and delivered on a trestle 15 ft. above ground level. Here it will be discharged through a special unloading hopper to a belt conveyor running to storage bins above the kilns or, when shipments temporarily exceed the demand, the material will be stored in a space provided for that purpose, extending 2000 ft. along the river front and 200 ft. deep. Distribution of material in this area is taken care of by traveling bridge crane, of 150-ft. span equipped with a 10-ton Brownhoist grab-bucket. The kilns consist of 10 Vulcan 8x125-ft. rotaries designed for oil firing and constituting, it is said, the largest installation of the kind in the world. Arrangements have been made to trap the fine flue dust from the kilns with a view to selling it as a byproduct. The hot gases from the kilns are to be utilized for production of power. For this purpose they are conducted to a battery of three 1200-hp. Stirling type Babcock and Wilcox boilers. These boilers, aided by additional liquid fuel, supply steam at 250 lb. pressure and 100 deg. superheat to three 1500-kw. Curtis type General Electric turbines, direct connected to generators which supply power for the entire plant. The turbines are designed to run non-condensing, the exhaust pressure being 10 lb. above atmospheric. The exhaust steam is to be used for evaporating the caustic potash liquor to the required degree of dryness. The lime on leaving the kilns passes through 10 Worthington 5x50 ft. rotary coolers, and thence to a battery of specially designed slaking units. It is slaked with a considerable excess of water or dilute caustic potash solution, and the thin slurry so formed is pumped to weighing tanks from which it is drawn as required for mixture with the greensand.

The greensand can be delivered by rail or by water. In either case it is unloaded by means of the bridge crane and either deposited in the storage space or delivered to bins from which it is to be drawn as required by tube mills in which it is ground to a fineness of 90 per cent through 200 mesh. It will then be mixed with water and pumped to weighing tanks, from which it is discharged into mixing tanks with the lime slurry from the slaking machines. The mixtures when properly proportioned will be pumped to digestors.

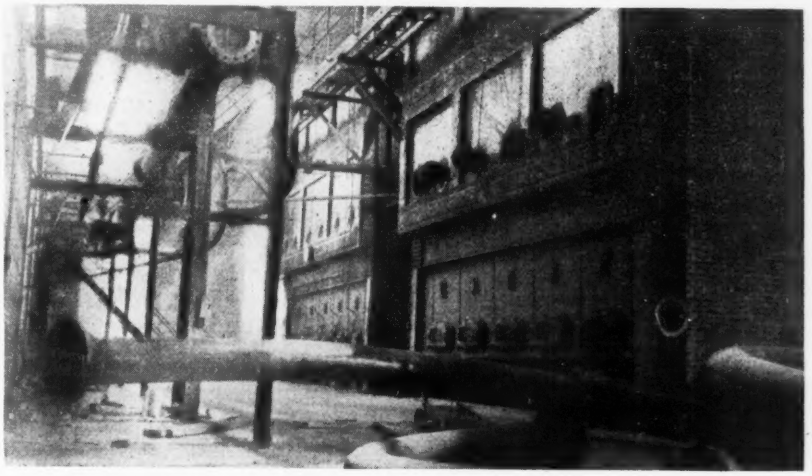
According to present plans there will be 28 of these units, each consisting of 360 ft. of 12-in. pipe through which the slurry is slowly forced by centrifugal pumps, pressure being maintained at 600 lb. per sq. in. At the entrance of the tube live steam supplied by special boilers will be admitted at 600-lb. pressure which raises the temperature to about 480 deg. F.

During the passage through the digestors, the duration of which can be varied as desired, most of the potash in the marl is changed into potassium hydroxide, a portion of the lime changing to calcium silicates. The slurry is then to be conducted to a battery of twenty-four electrically operated Atkins-Shriver filter presses arranged for automatic discharge. Here the potash bearing liquor is to be pressed out of the slurry, while the residue, consisting of silicates of calcium, iron, and aluminum, is separated and sent to the byproduct plant. The liquor is pumped back to the lime slakers and is used over again until a certain concentration of potassium hydroxide is obtained, after which it is to be pumped to a Manistee quadruple effect evaporater having a capacity of 5000 tons of water per day, the necessary heat being supplied by the exhaust steam from the power plant with provision for bleeding in additional live steam if needed. After being concentrated to 45 deg. Beaume it will be pumped to ordinary cast iron, oil-jacketed caustic pots where it is concentrated to commercial caustic potash (90 per cent KOH.) It is estimated that for every ton of greensand containing 140 lb. of potash (K_2O) delivered to the digestors, 155 pounds of commercial caustic potash will be produced. At full capacity the plant should be capable of a production of a little better than 75 tons of caustic per day.

Byproducts of the Process

The amount of waste material from the filter presses involved in this production is a little less than 1900 tons. If the entire quantity were used for brick manufacture, a production of 3,000,000 a day would be involved. As it would be very difficult to market such a quantity, provision has been planned for the manufacture of 500,000 per day, the remaining filter cake being marketed as agricultural lime. The brick produced is very similar to common sand-lime brick as produced by the most modern processes. The company objects, however, to the use of the term in connection with their product since there is an important difference in method of manufacture; common sand-lime brick depends for its strength on calcium silicates formed by the action of hydrated lime on particles of silica while steaming in the autoclave; Eastern Potash byproduct brick depends for its strength on calcium silicates formed both before and during the autoclave treatment, and the amount of unneutralized calcium hydroxide remaining in the completed brick should therefore be less than in the usual sand-lime product. This advantage is somewhat offset by the presence of aluminum and iron compounds. The filter cake contains over 40 per cent lime (CaO) and experiments have recently demonstrated that it can be successfully used as a substitute for agricultural limestone. The secretary of the New Jersey state board of agriculture is reported to have estimated that the state should be a good market for a line containing byproducts of this nature. As newly established plants have recently developed a considerable demand for sand-lime brick, it would appear that there should be a market for the byproducts. The marketing of 500,000 sand-lime brick per day is a task of no small magnitude, while the disposition of 500,000 tons of agricultural limestone per year, even with the water transportation available, is also a task calling for a very great display of energy and ability.

It is of course impossible to say what the actual costs of production at this plant may be when operations on a commercial scale are begun. There are certain costs, notably those of fuel and of quarrying and freight on the limestone and greensand, which can be determined with fair accuracy by an outsider. The study of these costs indicates that if the process when developed



The waste heat boilers at the plant of the Eastern Potash Corporation consists of three 1250-hp. units generating steam from the hot gasses from the lime kilns. Two of the three boilers are shown here

on a large scale gives results equal to those reported to have been obtained in experiments, its commercial operation under present conditions may prove not unprofitable. If operations in every department are conducted at the highest possible efficiency it would appear that the cost may be brought low enough to compete favorably with imported material. Before German interests permit themselves, however, to be driven from the market, they will assuredly cut prices below their own production costs, and possibly below the best costs possible by the Eastern Potash process. Under such conditions, very sound management and strong financial position will be necessary to survive. It may be stated that from a purely technical standpoint, the Eastern Potash Corporation represents the most promising attempt yet made to extract potash from the greensand marls of New Jersey on a commercial scale.

The Three Operations Compared

The present condition of the companies representing the three main divisions of the marl industry is instructive. The prosperity of the small pits which are closely analogous with that class of coal mines known as "snow birds" indicates that the excavation and sale of marl as a fertilizer is at the present moment a profitable business. The fact that the owners of these properties prefer to remain small and intermittent producers indicates that the instability of the potash market is deterring these men and others from the investment of capital in permanent plants. The prosperity of those classifying and screening companies which have been successful seems to indicate that by competing with ready mixed fertilizers, and by the use of the highest class of salesmanship, these companies can succeed. The failure of certain other companies indicates that these concerns have serious problems to meet, most important among which are ignorance on the part of the general public as to the value of their product, and foreign competition aided by adverse freight rates. It is the third class of concerns—those which are attempting to extract soluble potash from the greensands—which present the most interesting problem. The development of this branch of the industry may well prove a decisive factor in some future war, and indeed indirectly it may prove vital in time of peace for there is little hope of the United States gaining supremacy in the manufacture of chemicals unless it controls its own basic materials. It seems not impossible that at present prices some of the processes already developed may prove successful, and that even with a further decline in prices, the best processes can succeed by efficient operation and sound business and financial management.

New processes are also under development, and some of these on a laboratory scale, have given promising results. The problems involved in the development of greensand as a potash ore are difficult but not more difficult than others which have been solved by conscientious scientific research.

The prize which is to be gained is a rich one, and is desired by many. Public interest in the matter is increasing, and it seems not too much to expect, that within the next few years, the use of crude marl as a fertilizer will have been revived on a large scale and that the extraction of soluble potash salts from greensand will be established on a sound commercial basis.

Recent I. C. C. Decisions

A FINDING of unreasonableness and and an award of reparation have been made in No. 11515, Glencoe Lime and Cement Co. vs. Director-General and Missouri Pacific, opinion No. 7703, 69 I. C. C., 243-6, as to the rate on limestone, from the complainant's quarries to its kilns on the Glencoe branch of the Missouri Pacific, during federal control, because it exceeded $8 per car, the rate made effective June 30, 1919.

The commission has dismissed No. 12633, Silica Sand Producers' Traffic Association et al. vs. C. C. C. & St. L., Director-General, et al., opinion No. 7720, 69 I. C. C., 359-62, holding rates on sand, from Ottawa, Oregon, Wedron and Millington, Ill., to Bluestone and Farmer, Ky., and Erwin, Tenn., are not unreasonable. The report also covers No. 12641, Same vs. C. B. & Q. et al., and No. 12642, Same vs. C. & O. et al.

Examiner Harris Fleming has advised the dismissal of No 13365, Roquemore Gravel Co. vs. Atlanta & West Point et al., on a holding that rates on sand and gravel, from Montgomery, Ala., to LaGrange, Ga., are not unreasonable. The complainant desired a reduction of the present rate of $1.13 to 90 cents.

Reparation on account of an unreasonable rate on stone has been recommended by Examiner H. C. Wilson, in a report on No. 12810, Columbia Quarry Co. vs. Director-General. The traffic in question, crushed limestone, moved from Valmeyer to Dupo, Ill., for delivery within the switching limits of East St. Louis between July 1 and October 25, 1918. The attack was against a factor of 70 cents per ton applied from Valmeyer to Dupo, which was reduced, October 25, 1918, to 30 cents per ton. The complainant asked for reparation to that basis. Hillyer said the commission should hold the 70-cent rate unreasonable to the extent it exceeded 50 cents per ton and award reparation to that basis.

The Commission has approved the proposal of the carriers to reduce the rate on cement from Leeds, Ala., to Virginia cities, from 29 to 21.5 cents. Thereby they will restore a rate cancelled without intention and restore a relationship that existed from some time in 1908 to March 5, 1922. On the last mentioned day, through error in an agency publication, the rate was increased from 21.5 to 29 cents.

Protest against the restoration was made by the Lehigh Portland Cement Co. on the ground that the proposed rate would emphasize the disparity in the level of rates from the cement-producing district around Birmingham, on the one hand, and the level from its Fordwick, Va., plant on the other, to the Virginia cities. The Southern, which makes the rate from Leeds, admitted there was a question in that contention about levels to be considered and said it was about to revise the rates.

"There's Lots of Country Out West"

ON his return from a trip to the Pacific coast states and Canada Secretary Sandles of the National Crushed Stone Association has this to say in the association bulletin for July 18:

"There is lots of country out West. At Victoria, B. C., we attended the greatest good roads convention ever held in the Dominion of Canada. Every province was represented. Good roads and more people are the great needs of Canada. Victoria is one of the pleasing pastime pleasure spots of all the world 365 days in the year. The land of flowers and good health. Their big ships sail west for the Far East. There you enjoy the balmy summer climate in daytime and sleep under covers at night. There good fellowship is knee deep and gives the visitor a royal welcome.

"In our own western states the good-roads sentiment is dominant everywhere. The automobile, motor bus and motor truck form a trinity of utility and pleasure. Out there, dry, hot weather causes floods. Melting snows flush the rivers. Two genial gentlemen from England were on the train with me. They were impressed and amazed with the size of America. One of them said:

"'This is a 'ell of a country. You ride two nights and a day and then you 'ain't' there.'

The Columbia river highway drive is wellnigh worth in itself a cross continent journey. Concrete, asphaltic concrete, macadam, surface treated, willite, and warrenite roads are in evidence."

Quality Control in Cement Manufacture

Fineness of grinding and time and temperature of burning, all mechanical rather than chemical problems, are important factors in the quality control of cement manufacture. They often make this problem a mechanical rather than a chemical one, as the author points out in this paper delivered at a recent meeting of the Portland Cement Association. He proposes here practical solutions of some of these mechanical problems

By Richard K. Meade
Consulting Engineer, Baltimore, Md.

CONTRARY to the general belief, the question of the quality of cement is more often a mechanical than a chemical problem—or rather perhaps one of the relation of the mechanics of the process to the chemical composition of the product. The connection between the chemical composition of cement and its physical properties is now so well understood that there are few instances where the poor quality of the cement is due to a lack of knowledge of what the chemical composition of this should be. Generally speaking, poor quality is due to circumstances which interfere with the attainment of the ideal composition by the chemist. In speaking of composition in this paper the term is not limited to the mere analysis of the cement, but includes the proper combination of the elements to form the so-called cement clinker.

The problem of manufacturing good clinker in laboratory quantities is extremely simple. It is merely necessary to grind finely a properly proportioned mixture of argillaceous and calcareous substances and then to ignite the mixture to the point of incipient vitrification for a sufficient time to allow proper chemical combination of the elements composing the mix. All the details of the process are well understood by cement chemists—the proper relation to be had between the argillaceous and calcareous elements, the fineness necessary to secure intimate contact and the degree of burning to promote combination are all matters of common knowledge in the industry. When it comes to handling large quantities of natural materials and to manufacturing cement economically, however, the problem is vastly complicated. To begin with the raw materials, these generally vary considerably in chemical composition in different parts of the deposit and the method of accurately sampling and proportioning these materials is one of the most troublesome problems with which the cement manufacturer has to contend. The question of the degree of grinding is generally limited by the mechanical equipment provided and is always influenced by the question of economy. The problem of burning is much simpler than the other two and is usually merely one of securing experienced and conscientious kiln attendants.

How the Three Operations Are Related

These three primary operations of cement manufacture bear a general relation to each other. Some years ago I called attention to the fact that, assuming the chemical composition to be correct, there is a very definite relation between the fineness of the materials, the temperature of burning and the time at which the materials are subjected to this temperature. I can possibly best illustrate this relation by means of a mathematical formula thus:

$$F \times D \times T = C$$

In which F represents the fineness, D the temperature, T the time, and C clinker (a constant quantity). It will be seen that if C is a fixed quantity the others can vary among themselves and still equal C. Thus with a coarsely ground mixture the time or temperature of burning one or possibly both, must be increased to secure proper combination. Similarly if the time in the kiln is short this must be made up for by higher temperature or finer grinding.

If the fact that the composition of the mixture of argillaceous and calcareous substance can vary is considered, another variable is added to the equation. It is, of course, well known that it is much easier to burn low lime cement than high lime cement, in which case coarser grinding satisfies. In actual practice, the details of cement manufacture, therefore, are a general compromise to suit local conditions between chemical composition, fineness of grinding and degree of burning.

I am not going to discuss the question of fine grinding of the raw materials or the degree of burning, beyond saying that fine grinding and harder burning as indicated above will tend to correct faulty composition in some instances. The importance of fine grinding of the raw materials and of proper burning are, of course, better understood and when these are the cause of poor quality the remedy is evident.

My own experience indicates that the problem of making cement of uniform high quality is largely one of absolute control of the chemical composition of the mixture fed to the kilns. Occasionally I have met with a plant where the raw grinding or burning equipment was insufficient, but for the most part the failure to control the chemical composition of the mix has been responsible for the irregular quality of the product.

Chemical analysis of the cement does not always show the trouble, particularly when this analysis is confined to a sample representing a large quantity of cement, such as a bin of several thousand barrels or a day's run, because such a bin of cement may be the average of several hours of very high limed and consequently unsound cement mixed with several hours of low limed cement; the average of the two being often near the desired chemical composition while the physical properties of the resulting cement pertain somewhat to the undesir-

able characteristics of both the high limed and low limed clinker.

Where Wet and Dry Processes Differ

Such a result is quite apt to occur in the dry process, where chemical control is generally a matter of examination of a mixture already made rather than of two materials about to be mixed. It is, of course, well known to most cement manufacturers that the routine tests of the dry mill laboratory are post mortems rather than diagnoses. They are of no value so far as correcting the composition of the particular lot of raw material under examination is concerned but serve as a guide to the making of succeeding lots.

By far the larger number of mills, both wet and dry, make their mix by means of what are, in the vernacular of the industry, known as "readings." That is, samples of the mix are drawn from the grinding mills at stated intervals of time and in these samples the carbonate of lime is determined. If this is found to vary from the desired standard, no correction can as a rule be made in that portion of the mix which has already been prepared, and the test serves principally as a guide to the proportioning of succeedings lots. When the mix is controlled by such a process, the chemist finding his mixture too high or too low in lime (as shown by the reading) decreases or increases his limestone to correct his proportions. In the dry process this often has the effect of sending his composition to the opposite extreme, with the result that while his low lime and high lime clinker will average properly very little of it is per se of correct composition.

Advantages of Wet Process

In the wet process, however, an opportunity is generally given to mix the whole lot of ground material by combining the contents of several slurry basins in one large kiln feed basin and in this way the averaging is done before the kiln is reached and hence the clinker is of correct composition.

At many dry process cement plants, the question of chemical control is largely one of good judgment on the part of the chemist rather than of chemical test. For example, let us cite the case where a limestone and shale plant is supplied with rock by one large steam shovel. The shale is regular but the various strata of limestone differ much in chemical composition. Added to this variation is also the fact that 3 or 4 feet of clay overlying the limestone is not stripped from the latter but is blasted down with it. Deep well drills are used and the shots are large, each representing several months' supply of stone. All stone is sent direct from the shovel through crushers into a relatively small storage bin and the mix is controlled entirely by "readings" taken from the tube mill discharge. Let us suppose, as frequently happens, the shovel is working in the morning on clean limestone comparatively free from stripping. At noon, it encounters a limestone mixed with stripping and by night it has worked through the stripping and is back on the clean stone. What happens to the mix is this—some time during the afternoon the sample drawn from the tube mill shows the mix to be overclayed and the chemist accordingly decreases the shale. The orders to make this change probably reach the raw mill about the time the shovel reaches the clean stone again with the result that the next sample drawn from the tube mill will show the mix over-limed. At this mill, the mix would generally be wrong but for the visual inspection and good judgment of the chemist. This condition is by no means unusual and while probably not existing often in quite such an exaggerated form, does occur in a more or less modified form at many mills.

In my opinion, it is everlastingly to the credit of the American cement chemist that he can make cement superior to any in the world with the crude methods often supplied him. He may not be as "long" on theory as his English and German confreres but for the exercise of good, hard, common sense and rare judgment he has them both, to use a slang expression, "backed off the map."

Improving Quarry Efficiency

So far as quarrying methods are concerned, the steam shovel and the deep well drill are likely to stay, and it is also in most instances more economical to include the overburden in the blast rather than to strip; at the same time, it is evident that these three improvements in quarry efficiency have increased materially in most instances the difficulty of securing a uniform mix. The big blast throws down the entire vertical face of the quarry in one jumbled heap. If it served also to mix the various beds intimately it would be of advantage. Unfortunately the opposite is generally true, and the beds remain almost as separate, but not as easily segregated, after the stone is blasted down as when in the position left by nature. In the case of the old method of quarrying by means of 16 to 20 foot benches, the beds were usually blasted down in some sort of order and could be quarried uniformly. The steam shovels also confine the stone supplied the mill to that obtainable from one or two points in the quarry, while with hand loading the stone can be obtained from almost the entire area of the quarry.

If the overburden could be intimately mixed with the stone there would generally be no objection to its being blasted down with the stone. Unfortunately this result can not often be obtained and the overburden usually lies over part of the rock only.

With these new conditions occurring in the quarry, provision must be made at the mill to take care of the irregular supply of stone and clay sent to the mill by the shovels. The influence of occasional variations in the composition of the raw materials are designed to be taken care of at most plants by storage bins of varying forms and sizes.

Usually the shale or clay supplied the mill, whether obtained by means of shovels or hand labor, is of regular composition. Sometimes with clay the moisture content needs careful supervision. A few mills use a calcareous shale in which the lime content varies over quite a range. The use of such shale always greatly complicates the problem of controlling the chemical composition of the mix by introducing two variables instead of one.

Why a Large Stone Storage Helps

The employment of a large stone storage divided into two or more bins seems to be the most feasible method of securing a uniform raw material. In many instances, however, such stone houses are poorly designed. If we place rock continuously on the middle of a pile and draw at the same time below from the center of this, we will obtain pretty much the same stone that is being delivered to the pile and very little if any mixing will occur. Even where the discharge is not directly under the point of filling this flow of material between the two points occurs. In designing a stone house, therefore, this should be divided into at least two bins, but I do not think anything is gained by numerous small tanks or bins.

Another action which should be kept in mind is the so-called segregation of materials in the bins. If a mixture of coarsely crushed limestone is fed from an overhead source into the center of a pile it will be found that the coarse material will roll to the outside of the pile while the fine material will lie where it falls. If the pile is tapped from the center the first material drawn is almost entirely the fines, while the coarse material is the last to be obtained. As the fine material usually contains the stripping and is always lower in lime than the coarse material, it will be seen that the composition of the material obtained when the pile is first tapped will be much lower in lime than that of the last portion obtained.

Many plants employ what are termed blending bins, consisting of large tanks in which the coarsely crushed material is stored. My observation has been that these bins instead of blending actually segregate, for the reason given above.

A Good Storage Method

It has always seemed to me that the

traveling crane and grab bucket afford excellent methods of storing limestone. With this outfit the material as crushed can be uniformly distributed over a large pile. There is no segregation of fines and coarse and the reclaiming can also be distributed over a large area. It is a simple matter for the chemist to work out for the crane operator a cycle of filling and emptying such a storage which will give uniform material and leave nothing to the judgment of the operator.

Another excellent storage is one consisting of several long rectangular and fairly deep bins filled by means of an overhead belt conveyor. This latter is in turn equipped with a traveling tripper. This tripper is so designed as to move at a regular rate slowly back and forth over the entire length of the bin and spread the material in uniform layers over this. If the bin is relatively narrow and the openings below are alternately to each side of the center line, the segregation between coarse and fine material is negligible where the stone is drawn from several openings.

For those who prefer a pan conveyor or bucket carrier to the belt conveyor, the buckets can be arranged to deposit the material at a number of points in the bin. No doubt other methods of securing the same result are available. Where a silo storage is employed, if the number of bins is sufficient to permit it, better results will be obtained by filling or emptying a number of these at the same time by some such method as I have suggested, rather than to fill and empty in rotation.

So much for the form of storage. Another fact which should be borne in mind is that the finer the rock is crushed the better will be the mixture obtained and the less segregation will occur in the bins. For this reason I would suggest crushing the materials as far as practicable before storage.

Determining the Proportions

For determining the proportions of the two materials where the mixing is done directly after the large stone house, two methods are generally employed. One is to obtain a sample of the contents of the bins of clay and limestone and mix the two as indicated by the analysis of this sample. The other is what is generally designated as the "reading" method and consists in mixing the two materials according to the results obtained from a determination of the carbonate of lime in the mix after this has been ground in the mill. In spite of the fact that it is apparently much the less scientific of the two methods, the second one will usually give better results. This is because of the difficulty of properly sampling material in large pieces mixed with fines and intermediates.

The only method of sampling such material which will give accurate results will be some system of crushing and quartering in several steps such as is used for ore sampling, and this would involve an expensive sampling plant. As an illustration of such a plant, let us suppose that the material came from the crusher in a pan conveyor. Arrangement could be made to trip every 10th bucket into a small crusher which would crush to say 1 in. and under. The discharge from this crusher would then be sampled and the sample crushed to say ¼ in. This ¼ in. material in turn would be sampled and the sample crushed to 10 mesh. The fine material could then be sampled and this final sample ground to the necessary fineness for analysis. It will be seen that such an arrangement would involve handling quite a lot of material.

In a cement plant using 1,000 tons of stone per day the first sample would amount to 100 tons to be crushed to 1 inch, the second to 10 tons to be crushed to ¼ inch, the third to 1 ton to be ground to 10 mesh and the fourth to 200 lbs. to be ground to laboratory fineness. It is doubtful if accurate results could be obtained with much smaller fractions. It will readily be seen that the equipment necessary for such quantities is beyond that now available in cement mill laboratories.

The methods necessary for securing uniform rock at the mill are the same whether the wet or dry process is employed and to my mind the desirability of such a supply of rock of uniform composition is as great in the one process as the other. In the older wet process plants, provision was made for adding clay or marl as desired to the ground slurry before this was pumped to the kiln supply basins. Today, however, when necessary to correct the composition of the slurry, the general practice is to mix two or more tanks to give the desired results, so that as far as the mix goes, the two processes approach each other much more nearly than they did when the raw materials of the wet process were marl and clay. In the matter of chemical control, there are unquestionably much better facilities provided at most wet process plants than there are in the general run of dry process mills. When difficulties of controlling the mix do occur in wet process plants, this is usually due to too few or too small slurry basins and kiln feed tanks or to improper or insufficient agitation.

Correcting Tanks in the Dry Process

I have always felt that the methods employed to control the mix at most dry process plants were insufficient and that a system of correcting tanks planned after those of wet process plants could be employed to advantage. If the grinding is done in two stages, such as with ball and tube mills, I would suggest the use of two sets of tanks or bins. One set of at least four, and better, six or eight tanks to be placed after the preliminary mills (ball mills) and one set of four or more after the secondary mills (tube mills). The tanks in the first set should be sufficiently large to take care of at least four hours' run of the mill. The system should be provided with an automatic sampler so that the contents of each tank can be sampled as ground. Where ample rock storage had been provided to give fairly uniform rock, the four tanks could then be used in this manner. One tank would be filling, the second tank would be under test and the third and fourth tanks would be used straight, or mixed if necessary to give the proper composition. When analysis proved a tank to be of incorrect composition it would be necessary to so proportion the next tank that the two could be mixed so as to give a mixture of correct composition. The second set of tanks would receive the fully ground material and these should also be provided with automatic samplers. They serve as a further means of correcting the mix when necessary by blending the contents of two or more tanks as the pulverized material is sent to the kiln. The mixing here is not as thorough as would occur when the two materials were ground, but still fairly good mixing would occur when screw conveyors were used to carry the mix from the tanks and considerable mixing would also be effected in the upper part of the kiln before the material began to form into balls.

At some plants, it would no doubt be found most convenient to use such a series of tanks for mixing; that is, to grind the materials separately to 10 to 20 mesh before the mixing is done. In this case certain tanks would be set aside for limestone and certain tanks for clay and both materials would be sampled automatically and mixed according to the analysis of these samples. It is comparatively easy to secure an accurate sample of 10 to 20 mesh material, while it is extremely difficult to obtain anything which will properly represent material crushed only to one inch. So that this system of sampling, analyzing and mixing will do with 10-mesh material but will not give satisfaction with one-inch material. The statement that the finer the material, the easier it is to sample accurately will hold good for all materials.

Devising Modifications

No doubt various modifications of this system would be devised to suit local conditions. For instance, at certain plants it might be found best to mix partly by analysis and then to do the correcting by adding to the contents of the tanks as drawn a small amount of clay or limestone ground to 10-mesh. I am not trying to outline a plan to be

followed by all plants, but merely to indicate lines along which such a system may be worked out. The cost of operating such a system would be low and the initial investment small. I believe the saving in other lines aside from quality would pay for the installation and upkeep of the system. Such saving would include fuel required to burn over-limed mix, power to grind under-lined clinker, labor due to greater kiln outputs, greater life of kiln linings, and so on.

In the earlier paragraphs of this paper, I have shown how the various steps in the process of cement manufacture bear one on the other. From this it will be evident that if there are shortcomings in one step these must be made up for in the next. If the composition is irregular, the grinding of the raw materials must be carried to the degree of fineness necessary to give sound cement from the high lime mixture as well as from the low lime. Every chemist knows that where the lime is high, much finer raw grinding is required than where it is low or even normal. In order to make sure of sound cement, the chemist must therefore grind finer where occasional runs of high lime material are encountered than where the mixture is constant. The proper fineness of the raw materials are therefore influenced to some extent by their composition.

Proper Burning of Cement

The proper burning of cement is largely one of feeding the material and fuel to the kiln at a regular rate. If the composition of the mixture is constant, it is evident that if the material is fed to the kiln at a regular rate and the kiln is kept at a definite temperature and revolved at a constant speed the resulting clinker will be uniformly burned. The trouble with the burning is, first, that the composition changes, requiring a higher temperature or a longer time in the kiln and, secondly, that the rate at which both raw material and coal are fed to the kiln is subject to violent and sudden fluctuations, or in other words, both coal and raw material "flood." I believe that where trouble with the burning results much of this can be eliminated by designing proper feeding arrangements for both raw material and fuel. The irregularities due to change of composition come gradually and can be kept up with, while the feeding of the raw material is usually sudden and the extra load of material occasioned thereby is hard to catch and properly burn. The arrangements for feeding slurry to the kiln, where this is done by positive means such as buckets and scoops, are excellent and something of the same sort is desirable in the dry process.

Qualities Most Desirable

The qualities most desirable in cement are soundness, strength and uniformity in the rate of setting and hardening. All are dependent to a marked degree on chemical composition the fineness of the raw materials and the burning. These three steps are therefore the ones which must be under perfect control if quality cement is to be produced. I regard the chemical composition as the keystone of the arch. Unfortunately, it is the step least under control. While there are many plants where unsound or quick setting cement is a rarity, even here there might be an appreciable improvement in quality by a closer regulation of chemical composition. Most cement chemists are playing safe, as it were, rather than attempting to attain any ideals. Perfect control of the composition would enable them to make cements much higher in lime than they do at present, with the result that their clinker would be easier ground and the resulting cement stronger and more uniform in setting and hardening qualities.

Midwest Producers Discuss Car Shortage

SAND and gravel producers of western Indiana and central Illinois met at Danville, Ill., on July 11, with an attendance of 17.

The chief interest centered about the car-supply situation. It was the expressed opinion of all present that a serious car shortage would develop within the next few weeks. Steps were taken to discover, through the National Association of Sand and Gravel Producers the exact status of the car situation.

It was the sentiment of the meeting that the national association should keep in intimate touch with the car situation and discover, from the car-service divisions of the Interstate Commerce Commission and the American Railway Association, just what steps will be taken to give producers equitable car supply if a serious car shortage develops.

Danger of stopping all work on hard roads in this section as a result of car shortage was emphasized.

A poll of those in attendance showed that all were favorable to a national association representative of this industry. The larger number indicated their intention of taking out individual membership in the national. Others said they would consult other members of their firms with a favorably recommendation.

The firms represented were:

Carmichael Gravel Co., W. P. Carmichael, E. G. Sutton.

H. D. Conkey & Co., H. D. Conkey, Mr. Van Etten.

H. H. Halliday & Co., H. H. Halliday.

Lincoln Sand and Gravel Co., John Brandt.

McGrath Sand and Gravel Co., T. E. McGrath.

Missouri Portland Cement Co., C. A. Homer.

Montezuma Sand and Gravel Co., Mr. McCubbin.

Neal Gravel Co., H. E. Neal, J. P. Cantton.

Peoria Washed Sand and Gravel Co., Elwood Bienemann.

Springfield-Pekin Sand and Gravel Co., M. D. Schaff.

Summit Sand and Gravel Co., J. R. Connelly.

Wabash Sand and Gravel Co., Lee R. Witty, Henry Ensminger.

Beder Wood's Sons Co., Beder Wood.

Railroads Discriminate in Favor of Coal

A LETTER written by Col. W. W. Boxley, of the firm of W. W. Boxley & Co., of Roanoke, Va., and also mayor of that city, says:

"Our railroads are asking for more ballast and our commercial business is very brisk. The most serious thing I can see ahead of us now, however, is the question of open top cars, and I want to know if there is any law whereby coal operators have a preference over stone producers.

"We are producing on an average of about 75 cars of stone per day, with 50 per cent going commercially and 50 per cent going to railroads; it takes a great quantity of open-top cars to handle this business. We are right in the field of non-union miners, of course, and every effort is being made to keep coal cars to the non-union mines, but should this be done to the ruin of our business? They have kept us in cars up to this time, but we have been notified that our commercial car supply for stone would be considerably curtailed in very near future, so as to furnish open-top cars to coal fields."

Texas Cement Rate Authorized

THE Texas Railroad Commission on July 17 authorized a rate of 30½c per 100 pounds on cement, carloads, minimum weight 34,000 pounds per car, from Harrys and Eagle Ford to stations on the Chicago, Rock Island & Gulf, Soney to Glen Rio, inclusive.

Developing Gravel for Road Use

The experiences of the Maine State Highway Commission in surfacing gravel roads with tar may help gravel producers to extend the use of this material in other sections of the country. The following paper was presented at the annual conference on highway engineering at Ann Arbor, Michigan:

By Paul D. Sargent
Chief Engineer, State Highway Commission of Maine

FOR the last eight years the Maine State Highway Commission has been surface treating gravel roads with success. During that time we have used exclusively a refined tar product suitable for cold application.

Naturally, we more or less followed in our early tar applications methods in vogue at that time. We attempted to get a true crown on our gravel roads by adding an inch or an inch and one-half of new gravel where necessary and then by the use of a drag or light grader truing up the surface before the application of the bituminous material. The first year this work was done on any scale we applied our bituminous material in two applications. In May we used about 0.4 gal. to the square yard and about the first of August retreated all of these surfaces with an additional 0.2 gal. per sq. yd. Treatment was laid only 10 ft. wide. The real thing we sought to do with this treatment was to bond the loose surface material to the tightly bonded surface below it, and we fairly well accomplished this result.

Rippling and Waving

By the end of the season, however, we observed that on certain sections of our roads so treated there was a slight rippling and waving of the surface. It occurred to us that this might be on account of the fact that we had not secured an effective bond between the loose surface particles of the road and the tightly bonded gravel beneath. In other words, the material which had been impregnated with tar had laid more or less as a mat upon the surface, and not being sufficiently filled with mineral aggregate had pushed.

We had obtained, however, a much more satisfactory surface, generally speaking, than we had ever before seen on any surface treated road. The good sections presented the appearance of a first-class bituminous macadam surface, tightly sealed, smooth and dustless. As might have been expected, the edges of the bituminous treated section sheered off and crumbled away on account of so much traffic turning out for meeting and passing.

Our next development was an attempt to clean the gravel surfaces before the application of the tar. This was accomplished by the use of graders and drags and later by using a street sweeper and finally by following that with hand sweeping. We also increased the width of our treatments to 15 ft. We found that all of these steps gave us a much improved surface and, in fact, since the first year we have used tar we have never made but one application to any gravel surface during the season. No sand covering was used during our first two or three years of treatment. The tar was applied on warm, dry days from an automobile tank distributor under pressure, and we just allowed the tar to lie on the road until it was absorbed and took its set.

Treating One Side at a Time

Needless to say, we had much complaint from the traveling public on account of the dangerous condition of a freshly tarred surface for rubber-tired traffic. We attempted to obviate this danger as far as possible by treating one side of the road at a time. We would do a considerable stretch of road anywhere from 6 to 10 miles long, and treat it on one side only. While the treatment was being put on the first side the other half of the road was left open for traffic and by the time we had the first half finished the tar that had been first laid was well enough set so that traffic could go on it. Then the other half of the road would be treated in the same way.

We observed, of course, the steel-tired traffic wherever it ran on the freshly tarred surface stripped the bituminous material from the surface. This made it necessary to do more or less patching by hand. Also, on account of the increasing automobile traffic, which was continually getting on to the freshly tarred surface, we found it necessary to sand the tarred surface a few hours after application.

For the last three or four years we have made a practice of treating all of our surfaces 18 ft. in width, which has practically obviated the necessity of any patching on the shoulders or edges of the treated surface. Eighteen feet in width, which, by the way, is our standard width of pavements and hard surfaces today, affords a good double track way. We have been following the practice during the last three or four years of immediately covering the bituminous material with a light application of sand. By immediately, I mean that within 5 or 10 minutes after the distributor has delivered tar to the surface of the road it has been covered with sand.

Points Regarding Application of Sand

There are one or two points about sanding that I think should be spoken of. We place the sanding gang at intervals of 150 to 200 ft. apart, according to the length of road that the tank or tar will cover. Immediately the tar tank has passed, these men begin to sand and the sanding is started at the center of the road and first a place is made where passing vehicles may turn out on the freshly tarred surface. This affords traffic meeting places at stated intervals, so that with careful driving it is not necessary for a vehicle to become smeared or spattered with tar or to take the risk of skidding incident to driving on a freshly tarred surface. Our sanders are also instructed to keep an eye to the traffic so in case anyone gets into difficulty we will have some witness as to what actually happened. These men also more or less caution drivers to be careful. Where we are applying tar over a summit grade we always plan to have a sander stationed at the summit to keep an eye to passing vehicles and to warn them against collision. These are points we have learned from experience and we have found them to pay. I offer the suggestions for what they are worth.

Present Standard Practice

I might say that in general we have developed the following standard practice: As early as we can get on the roads in the spring, that is, when the roads begin to settle and dry out after the frost has left them, we begin shaping with the

road grader. The roads are carefully watched during the two or three weeks while they are settling and are shaped either with a drag or blade grader several times if necessary to have them settle with as true a contour as possible. The next step in our surface treatment is to draw out sand, which is left on the shoulder of the road in piles of about ¼ yd. every 25 ft. Generally speaking, we use about 50 yd. of sand to a mile of cover. We use less sand, however, on a brand new treatment than we do on retreatment. Sometimes as little as 30 yd. to a mile is used on the original treatment. Retreatments will take from 40 to 50 yd. per mile, as the tar has less opportunity to penetrate into the surface of the road. The next step is to clean the surface of the road of all loose materials. If a pocket of sand, dust or stone is left on the surface we are absolutely sure to have the treatment break over that pocket in a short time after application. This cleaning is done by the use of a street sweeper behind a light truck and if further cleaning is necessary after the sweeper has finished this is done by men with push-brooms. Then comes the tar distributing gang, which is equipped with Kinney pressure distributors mounted on 3½-ton trucks. We have limited ourselves to this size of equipment because it is as heavy as our roads, generally speaking, will carry. We have a law which limits the gross weight of load to nine tons, and I am free to say that one of these 600-gal. tanks filled with bituminous material will a little exceed the limit set up by statute for the gross weight of load. Under average conditions one tank truck will spread about 2500-gal. of tar per day.

We still hold to the practice of tarring one side of the road at a time and several days may elapse between the tarring of the first and the tarring of the remainder of the road. As pointed out above, immediately after the tar is applied a light sanding is given. We put on just enough sand to fairly blot the bituminous material and keep it from running off the crown of the road to the edge. The surface is carefully watched for three or four days, and if evidence of bleeding shows up spots where this occurs are treated with more sand. Sometimes after a treatment has been down for two or three weeks an extremely hot day will start a little bleeding. This is watched carefully by the patrolman and the same treatment of light sanding given.

In the treatment of new gravel surfaces, that is, surfaces which have never received a treatment before but which may have taken traffic anywhere from two to four or five years with an occasional resurfacing of gravel, we use not to exceed ½ gal. per sq. yd., and in more cases probably use 0.4 to 0.45 gal. per sq. yd. for the treatment. The amount of material depends upon the tightness of the surface. We have found that the smallest quantity of material we can use and get the surface covered gives us the best result. With a small quantity we never have trouble from rippling or waving of the surface, provided the gravel is in proper shape to receive the treatment when it is given, that is, thoroughly bonded and tight with no pockets of loose gravel, dust or other material. We also find that surfaces which have received a small quantity of tar can be re-treated for a longer time than surfaces which have been given a heavier treatment. Those which have received the heavier treatment will ripple and get out of shape, say in two or three or four years, while sections receiving a light treatment can be maintained without breaking up for a considerably longer time.

It must be borne in mind that the addition of the bituminous surface treatment to a gravel road does nothing but preserve the surface against disintegration from passing traffic. It does not materially strengthen the road in the sense that it will cause the road to carry heavier loads than the gravel surface itself or the foundation upon which it is laid will sustain. Surface treatment will not supply or take the place of drainage.

Maintenance of Surface Treated Sections

Our surface treated sections are kept under constant patrol maintenance. We patrol these roads with a light truck and two men and they are assigned sections anywhere from 12 to 18 miles long. Besides watching the bituminous surface and mending any small breaks that may occur—and we have these breaks occasionally—and patching the shoulders, these men also keep the dirt shoulders shaped by dragging, keep the gutters and culverts clear and do whatever other work is necessary. We supply about 3 bbl. of bituminous material like that with which the road is treated for each mile of surface. This material is mixed with sand and kept in stock piles. The mixing is usually done by hand, and we use about 17 gal. of tar to cu. yd. of sand. In a few instances we have used a small concrete mixer to prepare the tar and sand for patching and we have been able to use as little as 14 gal. to a yard of sand when the mixing is done in a concrete mixer. Patches are made by simply cleaning out the hole, throwing in the mixture if bituminous material and sand and patting it in with a shovel. Any bad breaks on the shoulders are repaired the same way.

Condition of Gravel Treated Surfaces in Spring

The most of our gravel treated surfaces do not remain intact over the spring period; a good deal of it breaks up. This is due to several causes. An open winter which allows the frost to penetrate deeply into the roadbed and allows traffic to run all winter long, or heavy traffic coming on these surfaces when the frost is leaving and the surfaces are soft will break up and generally disintegrate the surfaces. This really is more or less of an advantage, because it obviates the necessity of breaking up these surfaces and we save just that much expense in getting the surface ready for subsequent treatments. I have in mind one section of gravel road which was surface treated during the summer of 1920. Most everyone called it a good section of road; in fact, many automobilists have referred to it as bituminous macadam and many of our citizens refer to our surface treated gravel roads as bituminous macadam roads, especially when they want to tell about a bituminous road the highway commission has built which has failed in the winter. The particular section I refer to was so bad during March, 1921, that automobiles could not pass over it or through it. For four or five miles this piece of road was literally a sea of mud for a period of about three weeks. Of course the surface treatment completely disappeared. We reshaped the road as it dried out and re-treated it last spring. It presented a good surface all through the summer and fall until it was covered with snow.

We have a good many sections of surface treated gravel roads which do not break up in the spring. The most of these sections get a re-treatment each year. The second year the amount of tar which we have used has been from 0.3 to ⅓ of a gal. per sq. yd. For the third and fourth years the amount has run as light as ¼ gal. and in some instances 0.2. These surfaces are quite apt, however, after three or four re-treatments, to become ripply enough so as to be uncomfortable to ride over. This condition is due to a combination of reasons. One is that we may have as much as 1½ or 2 in. of tar penetration which becomes separated from the gravel road itself on account of the passage of heavy loads when the frost is coming out of the roads and the whole roadbed is more or less soft.

Method of Treatment for Wavy Surfaces

Where this tendency exists at all it is always more pronounced where the surface has received successive treatments than where only one or two treatments have been given. Each year we have to break up more or less of this kind of surface and get the road in shape for new treatment. The method used is about as follows: We take a section of road about 1000 ft. long; it is broken up either by using a pressure scarifier on a steam roller or by using a heavy blade grader behind a truck or a roller and setting the blade so that it will do more of a plow-

ing operation than a scraping one. The bituminous surface is in this way broken up into junks anywhere from 2 in. to 2 or 3 ft. square. We next take a road grader and scrape this whole surface off to the shoulder of the road, then we plane the roadbed below to as true a surface longitudinally and transversely as possible. We then work back a portion of the bituminous bound material from the shoulder, distributing it over the surface. In this distributing operation the bituminous bound gravel is broken up more or less into small chunks. We then leave the road for two or three days for traffic, which materially helps in further breaking up these prices of bituminous bound gravel, then the road grader is brought on and further working of the surface is given just by pushing the junks around and pulling in more from the sides. By watching the surface carefully and using the road grader every two or three days we have been able to get the surface back into reasonably smooth condition. It presents more or less of a mottled or mosaic appearance.

Gravel which has been covered with the bituminous material has lost its binding property and it is necessary quite often to add a bit of good binding material here and there to complete the bonding of the surface. This binding material is used sparingly. We do not intend to have enough to leave any appreciable amount of dust to be swept off prior to the new treatment. As soon as we have the surface in shape we plan to immediately give it a new application of tar. We find that one of these surfaces broken up and reshaped as just described is very hard to keep in true contour under traffic, and if it is allowed to go, say two weeks, we may have to break it up and rebond it before the tar surface treatment is given, else it would be so uneven as to be a bad riding road all through the season.

Experience has shown that one of these old tar surfaces can be scarified and broken up more easily when the temperature is between 60 and 70 degrees F. than during cooler weather. Good warm, sunny weather also materially assists in breaking up the junks of tarred gravel which are left on the surface of the road.

One thing we have satisfied ourselves upon is the fact that we cannot successfully apply tar surface treatment on a wet road or on a damp road. We have also had the experience of rain falling within two or three hours after tar has been applied and before the tar has taken any set, and with a traffic say of 100 to 200 cars per hour this has resulted in making a mushy surface which it is practically impossible to true up and make satisfactory. We have practically come to the conclusion that when this condition prevails we would do better to scrape the new tar surface right off on the shoulder, throw it away, reshape our road and put on a new application of tar. We will spend more money in patching the surface which is laid under these conditions than it would cost to replace the surface, and such surface after patching has never been satisfactory.

Cost of Tar Application

During the last four years our surface treatment work, plus the cost of patrol maintenance, for a season of eight months, has averaged to cost $1,000 per mile. We estimate sand to cost us an average of $2.00 per cubic yard delivered in piles along side the road. Tar costs us $0.12 in tank cars delivered on the nearest railroad siding. We figure the cost of applying the tar at $0.02 per gallon. Sanding cost about $0.75 per cubic yard of sand. Using, say 4,000 gal. of tar per mile gives us a cost for tar on the roadbed of $560; 50 yd. of sand will cost $100, applying the same $37.50, making the cost of the tar treatment covered with sand $697.50.

Cost of Shaping

The average cost of shaping and getting the surface ready for treatment in the early spring would be about $25.00 per mile. We use ordinarily a 2-ton truck to draw the road machine. The truck rental would be $10 per day, the driver's pay $3.75 and a helper $3. The rental of the road grader is figured at $2 per day. Gas and oil will run from $5 to $6 a day. This outfit will average to smooth four miles per day. Usually on the first smoothing we make about four round trips per mile. On subsequent smoothings possibly two trips will do; it all depends upon the condition of the road when it is smoothed and the subsequent condition of rain and settling of the road.

Cost of Sweeping

For sweeping we use a mechanical sweeper drawn by a light truck, say a ¾-ton or a 1-ton truck. We usually make four round trips with the sweeper, and this outfit will sweep about two miles per day, as we can only run the sweeper about three miles per hour. The expense for sweeping would run about as follows:

	Per day.
Truck rental	$5.00
Oil and gas	2.00
Driver	3.75
Helper	3.00
Rental of sweeper	2.00
Total	$15.75

On the basis of sweeping two miles per day this gives a cost of $7.87 per mile.

The balance of the $1,000 is paid for patrolling the road through the season. The usual patrol gang in bituminous surface-treated gravel roads is a patrolman with a 1-ton truck and helper. According to the amount of traffic and the condition of the road, this outfit will cover anywhere from 12 to 18 miles of road. The outfit costs $13.75 per day, made up as follows:

Rental of one-ton truck	$5.00
Gas and oil	2.00
Patrolman, who drives the truck	3.75
Helper	3.00

These gangs work an average of 200 days per year, so if the patrol section was 13¾ miles long the average cost per mile would be just $200.

Based on the figures given above, this would show a maintenance cost of $930.37 per mile. I have said that on new roads we use ½ gal. of tar per square yard. That will increase the cost $140 per mile over the figures already given.

Where it is necessary to scarify or break up the old bituminous surface, we run into a considerably larger expense for preparing the surface than indicated above. I think I have given enough explanation, however, to show that the average cost is close to $1000 per mile.

There is one point that I neglected to mention, and that is that quite often in making an original treatment if traffic is running fairly heavy and it will take us six or eight days to treat the section we are working upon, we will slide over the road with a priming coat of the tar material, using 0.2 to 0.25 gal. per square yard, the quantity depending upon the tightness of the surface. This will hold our surface in perfect condition under traffic for a week or ten days. We immediately apply the balance of the quantity, sand, and finish up the job. We have almost come to the conclusion that it would be good practice to do the priming everywhere on new surfaces. It gives a better penetration of the bituminous material, besides holding the surface in proper contour until the treatment can be completed.

Traffic on Surface-Treated Gravel Roads

I ought to state before closing that we have many miles of surface-treated gravel roads which are carrying a 12-hour traffic, from 7 a. m. to 7 p. m., averaging from 2300 to 3500 vehicles per day for a week's time, with a maximum traffic during the 12-hour period of as high as 5500. This traffic continues for a period of four to five months, from about the 20th of May until well toward the first of October.

We find it impossible to hold our gravel surfaces in satisfactory condition by ordinary patrol maintenance methods.

Credit for the most of the developments we have made in surface treatment of gravel roads is due to A. J. Wiggin, superintendent of maintenance of the Maine State Highway Department.

National Sand and Gravel's Chicago Meeting

WHAT was aptly called "two history-making days" was the recent Chicago meeting of 14 members of the National Association of Sand and Gravel Producers' reorganization committee, to consider careful ways and means of reorganizing and increasing its acknowledged usefulness to the industry, the individual members and the whole nation.

Briefly, here is what happened:

A new and more democratic plan of National organization was decided upon, which is reflected in a proposed new constitution adopted.

A system of 26 districts was devised dividing the country into as many divisions, designed to meet new and changing conditions. A list of recommendations was drawn up, these recommendations being intended to serve as a suggested guide to the executive committee. A constitutional convention was decided upon, to be held as soon as practicable, this convention to be held at Chicago. The incorporation of the association was recommended. A change in name to read "The National Sand and Gravel Association" was recommended. Naturally, all these matters were decided only tentatively, to be approved, amended or rejected at the proposed constitutional convention.

An earnest effort had been made in appointing the members of the reorganization committee, to select men representative of this industry, representing the different shades of opinion hitherto existing, and who would consider only the best interests of the big majority. With this idea in mind, President Dann, at a meeting held in Washington on April 13, appointed the following producers:

Charles M. Ault, Barnes Sand and Gravel Co., Piketon, Ohio; C. P. Biesanz, Biesanz Stone Co., Winona, Minn.; W. H. Collins, Spruce Pine Sand and Gravel Co., Spruce Pine, Ala.; J. K. Jensen, Janesville Sand and Gravel Co., Janesville, Wis.; George C. Ross, Ohio River Gravel Co., Parkersburg, Va.;; J. L. Shiely, J. L. Shiely Co., St. Paul, Minn.; E. Guy Sutton, Carmichael Gravel Co., Williamsport, Ind.; H. E. Schellberg, Lyman-Richey Sand Co., Omaha, Neb.; H. N. Battjes, Grand Rapids Gravel Co., Grand Rapids, Mich.; J. B. Blanton, J. B. Blanton Co., Frankfort, Ky.; R. C. Fletcher, Flint Crushed Gravel Co., Des Moines, Iowa; Joseph R. McGraw, Ohio River Sand Co., Pittsburgh, Pa.; M. D. Schaff, Springfield-Pekin Sand and Gravel Co., Springfield, Ill.; W. L. Smith, Memphis Stone and Gravel Co., Memphis, Tenn.; John Prince (chairman), Stewart Sand Co., Kansas City, Mo.; J. E. Carroll, J. E. Carroll Sand Co., Buffalo, N. Y.

With the exception of Mr. Carroll and Mr. Schellberg, both unavoidably detained, the entire membership was present at all the meetings, O. C. Hubbard of the Janesville Sand and Gravel Co., acting as Mr. Jensen's representative.

The meetings were held in the La Salle hotel, and were attended, during the second day, by Mr. Dann and Mr. Johnston, members of the Executive Committee.

The spirit of the meeting was inspiring and became more and more manifest as the men present, called on by Mr. Prince to give their views, to offer their suggestions, told of conditions in their particular localities and what they believed should be done about it all.

The first session, entirely devoted to this discussion, was continued during luncheon served in an adjoining room, and continued until late in the afternoon, when Mr. Prince appointed the different sub-committees with a request that they report the next morning.

The chairman appointed the following sub-committees: Revision of Constitution and By-Laws.—E. Guy Sutton, Charles M. Ault, M. D. Schaff, W. H. Collins. Districts.—R. C. Fletcher, C. P. Biesanz, W. L. Smith, John Prince.

The report of the sub-committee on Revision of the Constitution and By-Laws, considered at the second day's morning session, was held in a more commodious room.

The proposed new constitution was read section by section and was finally adopted unanimously as amended. It will be the function of the constitutional convention to pass finally on the document. In the meantime, copies have been sent to the entire membership that they may be thoroughly conversant with all its provisions before the meeting of the constitutional convention.

Then came the report of the sub-committee on zones. The advice of all the members was sought as to these tentative boundaries, but it was acknowledged that they could be worked out definitely only after a long study. The sub-committee suggested 26 districts, as follows:

No. 1—Georgia-Alabama (including Florida).
No. 2—Carolina (including North and South Carolina).
No. 3—Virginia (including Maryland and District of Columbia).
No. 4—Ohio Valley (West Virginia and Eastern Ohio).
No. 5—Eastern Pennsylvania (including New Jersey and Northern Delaware).
No. 6—Western Pennsylvania.
No. 7—Western New York.
No. 8—North Atlantic Coast (including Eastern New York and New England).
No. 9—Michigan (Lower Peninsula).
No. 10—Ohio.
No. 11—Indiana.
No. 12—Kentucky.
No. 13—Eastern Tennessee.
No. 14—Louisiana (including Southern Mississippi).
No. 15—Tri-State (Arkansas, Mississippi and Western Tennessee).
No. 16—Illinois.
No. 17—Chicago.
No. 18—Wisconsin (including Upper Michigan).
No. 19—Minnesota (including North and South Dakota).
No. 20—Iowa.
No. 21—Nebraska.
No. 22—Missouri Valley (Kansas and Missouri).
No. 23—Oklahoma.
No. 24—Texas.
No. 25—South Pacific Coast.
No. 26—North Pacific Coast.

Then came the report of the sub-committee on recommendations to the executive committee. These were finally adopted by unanimous vote. The recommendations were:

That the national association give its serious attention to promotion of the use of materials produced by members;

That the executive committee be empowered to authorize the payment of traveling expenses of any officer, employe or member of the national association when such expense is necessary for the promotion of the welfare of the association in any district;

That a new form of membership application be adopted by the national association, which will represent not only a moral but a legal obligation, containing those provisions of the constitution and by-laws applying thereto.

The continuation of the present services of the central office of the national association, including car supply, handling of income tax problems, development of a suitable cost accounting system, and the valuable contact with the various governmental departments, bureaus and agencies whose activities have a direct or indirect influence on the industry.

The continuation of the publicity efforts of the general office and the extension of these efforts as the finances of the national association permit.

A monthly notice to all producers as to national legislation affecting the industry.

The continuation of all activities in support of legislation favorable to the interests of a majority of the members.

Investigation of a suitable marine insurance plan and of compensation insurance rates.

The incorporation of the national association.

There was also discussions covering a wide range of subjects such as the desirability of removing the central office to some other city, the present activities of the national association, the personnel of the Washington staff, the association's financial status, the cost of operation, etc.

Service to the membership, rather than an undue effort to increase it, was emphasized by several members.

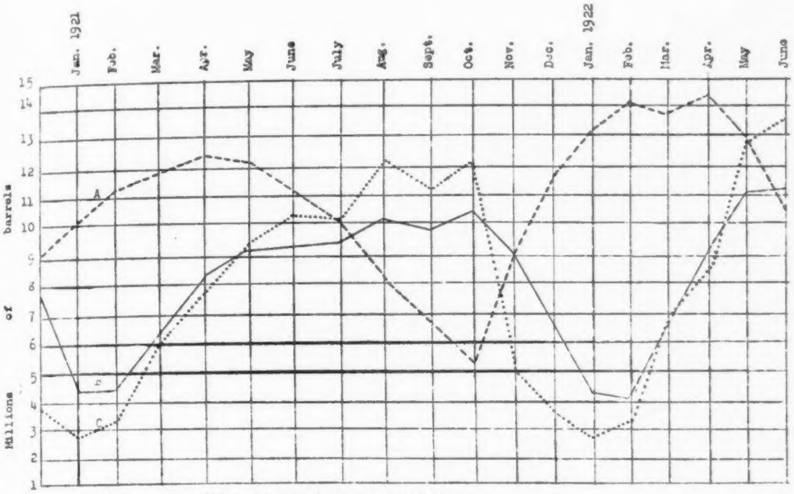
The proposal to change the name to the National Mineral Aggregate Association, or the National Sand, Gravel and Stone Association, was finally voted down, but it is believed this will be a matter of lively interest at both the constitutional convention and at the annual convention.

It was decided that the present members of the advisory council might serve as the board of directors provided for in the revised constitution and by-laws until such time as these directors may be elected as therein provided.

A formal motion was made and unanimously carried that the executive committee "be guided by the expressed attitude of the re-organization committee pending more specific instructions from the membership of the national association, or until such time as the reorganization plans can be perfected."

Cement Output in June

THE statistics shown in the following table, prepared under the direction of G. F. Loughlin, of the United States Geological Survey, are based mainly on reports of producers of portland cement but in part on estimates. The estimates for June were made necessary by the lack of returns from three producers.



(A) Stocks of finished portland cement at factories.
(B) Production of finished portland cement.
(C) Shipments of finished portland cement from factories.

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in May amounted to 2521 bbl., valued at $9117. The total imports in 1921 amounted to 122,317 bbl., valued at $388,825. The imports in May were, from Canada, 1676 bbl.; Japan, 790 bbl.; other countries, 55 bbl. The imports were received in Porto Rico, 1245 bbl.; Hawaii, 790 bbl.; Washington, 479 bbl.; Maine and New Hampshire, 5 bbl., and San Francisco, 2 bbl.

The exports of hydraulic cement in May were 100,068 bbl., valued at $284,493; of this total 97,889 bbls., valued at $270,853, was portland cement, which was sent to Cuba, 41,370 bbl.; the other West Indies, 3246 bbl.; South America, 24,389 bbl.; Canada, 11,573 bbl.; Mexico, 10,170 bbl.; Central America, 6555 bbl.; other countries, 586 bbl. The total exports of hydraulic cement in 1921 were 1,181,014 bbl., valued at $4,276,986.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT IN JUNE, 1922, AND PRECEDING MONTHS

Month	1921	1922	1921	1922	1921	1922
	Production (barrels)		Shipments (barrels)		Stocks at end of month (barrels)	
January	4,098,000	*4,291,000	2,539,000	*2,931,000	10,300,000	*13,316,000
February	4,379,000	4,278,000	3,331,000	3,285,000	11,400,000	*14,142,000
March	6,763,000	6,685,000	6,221,000	7,002,000	12,000,000	*13,848,000
First quarter	15,240,000	15,254,000	12,091,000	13,218,000	....	....
April	8,651,000	9,243,000	7,919,000	8,592,000	12,600,000	*14,470,000
May	9,281,000	11,176,000	9,488,000	12,749,000	12,450,000	*12,893,000
June	9,296,000	11,245,000	10,577,000	13,470,000	11,150,000	10,668,000
Second quarter	27,228,000	31,664,000	27,984,000	34,811,000	....	....
July	9,568,000	....	10,301,000	....	10,414,000	....
August	10,244,000	....	12,340,000	....	8,280,000	....
September	10,027,000	....	11,329,000	....	6,953,000	....
Third quarter	29,839,000	....	33,970,000	....	....	....
October	10,506,000	....	12,114,000	....	5,348,000	....
November	8,921,000	....	5,195,000	....	9,091,000	....
December	6,559,000	....	3,697,000	....	11,938,000	....
Fourth quarter	25,986,000	....	21,006,000	....	....	....
	98,293,000	....	95,051,000	....	....	....

*Revised.

South Dakota Will Not Build Cement Plant

SOME of the South Dakota newspapers assert that it is the opinion of members of the legislature that the state cement plant for the erection of which $2,000,000 was voted at the last session, will not be built, at least for a long time. It had been planned to build the plant at Rapid City, where the state had options on lands for the purpose.

A Pierre, S. D., dispatch in The Watertown *Herald* says: "Just what the status of the plant is as the present time is not known here as the cement commission has not held any meeting.

"However, it was at one time planned to begin the building of the plant this spring if prices of building material and labor was such as to warrant the beginning of construction, but as far as is known no steps toward building have been made though several thousand dollars worth of the $2,000,000 bonds were floated last fall.

"A. L. Freelove of Kennebec, who was representing Lyman and Jones county in the state at the last session, was recently in Pierre and expressed the opinion that the plant would not be built. He said the people of eastern parts of the state were generally against the proposition and he did not think the Black Hills section was for it with the exception of the town of Rapid City, where the plant was intended to be erected. Mr. Freelove was opposed to the building of the plant by the state in the senate, being one of the strongest opponents of the measure."

Finds Fossil Flower Embedded in Rock

FOSSIL flowers are such rare discoveries in the United States that the finding of a dogwood "flower" in a fragment of rock from the Glenrock coal field, Converse county, Wyoming, is of interest. Dr. F. H. Knowlton, a paleobotanist of the United States Geological Survey, identified the fossil as a species of *Cornus*, a typical genus of the dogwood family.

There are some 40 or 50 living species of the genus *Cornus*, which is widely distributed over three continents of the Northern Hemisphere and has one representative south of the Equator, a species in Peru. The leaves of more than 20 fossil species of *Cornus* have been found in North America, but the dogwood flower just identified is the first one yet found in the United States. Species of dogwoods first appeared in the middle of the Cretaceous, the geologic period in which dinosaurs lived; in other words, the genus *Cornus* seems to have made its first appearance probably more than 4,000,000 years ago.

Sunderland Bros. Co. Move into New Home

To celebrate the beginning of its fortieth year in business, the Sunderland Bros. Co., Omaha, Neb., has moved into its new home—and its own home. Like many other prosperous firms supplying structural materials today, Sunderland Bros. Co., started years ago—1883, to be exact—in a small way, dealing in coal and building materials. The growth of this company has followed very closely that of the city.

The new building, on Fifteenth and Harney streets, is decorated with numerous examples of fine work turned out by the Sunderland mills, notably the marble in the lobby. When the display rooms are completed they will contain a veritable exposition of building materials.

There are three well equipped yards handling the general retail business and a general warehouse and a new marble mill. J. A. Sunderland is the head of this company.

$225,000 Fire at Louisville Cement Mill

Fire departments of two cities battled to save the cement plant of J. B. Speed & Co., a mile north of Sellersburg, Ind., on July 13, when flames broke out in the hydraulic mill and rapidly swept through several warehouses of the "brixment" unit. The old plant and a number of warehouses and mixing rooms were destroyed. The loss is estimated at $225,000, fully covered by insurance.

The fire started in the brick cement plant where crude oil is used in the production of the cement bricks, and it is believed someone may have dropped a cigarette near the outside of the building.

The burned plant employed 100 men, and was turning out 1,800 barrels of brick cement daily. The main loss was on machinery used in mixing. The men thrown out of work will be promptly used, according to Supt. H. D. Baylor, in erecting new buildings. The fire will not interfere with the production of cement in the main plant.

Gypsum as Insulating Material—Poured on the Job

A new process of insulating houses in which the material is poured in place for the insulation of ceilings, or poured on the floor, cut in slabs, and inserted in the studding or elsewhere, has been perfected by H. S. Ashenhurst of the Illinois Asbestos Products Co., Chicago. Its trade name is Insulex.

This material is composed chiefly of gypsum. With it materials are combined that cause the gypsum, when mixed with water, to swell to great bulk before it sets. This swelling process resembles the rising that takes place in bread through the action of yeast. The resultant product is a very light porous material containing millions of tiny air cells which are visible to the naked eye.

This material is sent to the job in powdered form. Water is then mixed with the powder and the mixture, which sets in a few minutes, is then poured in place. In 30 min. the Insulex is hardened. Because but little water is used no wood swelling occurs and the mixture dries in a short time. The volume of the gypsum plaster used increases from 200 to 500 per cent, it is stated, according to the amount of the gas-forming compound used, thus making the use of gypsum economically possible.

Saving from radiation, as shown by tests by the Armour Institute, range from 52 to 77 per cent. Insulex has been tested by the U. S. Bureau of Standards, it is said, and approved by the U. S. Navy for pipe and boiler covering. As a means of economical and rapid insulating, fire-stopping and vermin-proofing this new material is of singular interest.

With its wider use, and when its value to the construction field is better known, this new application of gypsum should give it a wonderful place in that industry and find a large market for its consumption.

Making Concrete Roofing Tile

After a year's experimentation, the Cleveland Builders Supply & Brick Company, has added to its list of fireproof building materials a product known as concrete roofing tilé. This new tile comes in green, red and gray, has interlocking edges which insure a watertight as well as firetight roof.

After the tiles are molded they are put through a steam curing process and then air cured for a time to give the cement an opportunity to set and develop the strength required. Another feature claimed for this roofing is that it is low both in first and maintenance cost.

A. G. C. to Study Concrete Specifications

At the recent meeting of the executive board of the Associated General Contractors, L. C. Wason, speaking for Col. Whitson, chairman of the special committee on concrete specifications, reported that the committee had concluded that the making of tests in various parts of the country by contractors would be futile and would not warrant the expense and trouble involved. The executive board sustained this opinion and disapproved the suggested series of tests.

The committee, however, was continued and authorized to prepare specifications for concrete and reinforced concrete. It is understood that it is not the intention of the contractors' committee to publish concrete specifications in competition with those of the joint committee of the engineering society, but that it was considered that the preparation of specifications would be the best way for the contractors to bring their ideas to the consideration of the joint committee, which has prepared tentative specifications, many features of which are not satisfactory to the contractors engaged in concrete work.

Phillips Plans a Coast-to-Coast Trip

It is announced that W. R. Phillips, the recently appointed general manager of the National Lime Association, is planning a six weeks' trip from coast to coast to visit lime plants and to get in touch with conditions in the lime industry.

The trip will start early in August, soon after the directors' meeting which is to be held on August 3, at Washington, and Mr. Phillips will return in time for the second 1922 convention of the association which is to be held in October.

Deny Revision of Lime Rate Rule

A joint petition of Minnesota railroads for permission to increase the minimum weight on carloads of lime from 24,000 to 30,000 lbs. has been denied by an order of the Minnesota railroad and warehouse commission.

Fall shipments under 24,000 lbs. now are paid for on a basis of that amount, while the shippers would be required to pay for an additional 6,000 lbs. were the request of the railroads put in effect.

"An increase of the minimum weight on lime at this time would prove a hardship to the manufacturers of Minnesota," Ivan Bowen, member of the commission said.

To Harmonize Road-Building Practice

The committee on tests of the American Society of State Highway Officials met with the officials of the Bureau of Public Roads of the U. S. Department of Agriculture in Washington, D. C., recently to consider standardization of specifications and tests for road materials. The purpose of this meeting of representatives from all sections of the country was not so much to lay down rigid rules as to harmonize the general practice. Standardization taking into account local conditions is being brought about by a series of meetings between officials from groups of states and engineers of the bureau.

Book Reviews

MATERIAL HANDLING CYCLOPEDIA—A reference book covering definitions, descriptions, illustrations and methods of use of material handling machines employed in the industry. Compiled and edited by Roy V. Wright, managing editor Railway Age and editor of the Railway Mechanical Engineer, Car Builders' Dictionary and Cyclopedia, and Locomotive Dictionary and Cyclopedia. Published by Simmons-Boardman Publishing Co., New York City. Bound in cloth, 12x8; 846 pages.

This really remarkable work comes to ROCK PRODUCTS with a big message to all in our field who have to do with material handling machinery. In its preparation the editors kept in mind two principal objectives: First, to present the information in easily understood terms, and, second, to so arrange the text that the reader might be able to find the information he requires without loss of time.

To accomplish the second objective it was thought necessary to subdivide the editorial matter into two parts: a definition section and an illustrated text section. Both of these sections have been subdivided; the definition section into two parts—general definitions and electrical definitions—thus making it possible to arrange the major portion of the definitions in alphabetical order and at the same time preserve a logical continuity in the treatment of electrical subjects.

The illustrated text is subdivided into eight principal sections: hoisting machinery; package handling conveyors and elevators; loose material conveyors and elevators; conveying machinery details; elevators; trackless transportation; industrial rail transportation and handling systems. These subdivisions appear in the order named and each is further divided into sections corresponding with the logical classification of the great number of devices properly grouped under each major subdivision.

To furnish further guidance to readers interested in the information in the catalog pages three indexes appear on the pages following the catalog section, viz., an alphabetical index of catalogs, a directory of products, and a trade name index. The alphabetical index contains a list of the firms represented in the catalog section and the numbers of the catalog pages on which their products are described. In the directory of products is an alphabetically arranged list of the products of the firms whose catalogs appear in the catalog section. In the trade name index, are the names of the various products shown in the catalog section. The name of the manufacturer appears after each trade name.

Of special interest to those in the rock products industry are these industries: Ash handling, barrel, boiler and cement manufacturers; coal and ash handling, concrete plants, contractors in earth, rock and concrete work; fertilizer and glass works; industrial plants; lime kilns; machine shops; power houses; quarries; rock handling; sand and gravel companies; sand handling; storage; store houses, etc.

This work, says the publishers, is to "show you how to select the device that reduces your handling cost to a minimum. If your system is already installed, how to supplement it. Consult catalogs, of course, but which ones? To get rid of the 'if's and buts,' and thus reduce the vital cost factor, is the substantial reason for this material handling cyclopedia."

The publishers say that this work cost $75,000 before it went to press, but that the demand has justified this expenditure.

HANDBOOK FOR FIELD GEOLOGISTS—By C. W. Hayes, Ph.D., late geologist of the United States Geological Survey. Published by John Wiley & Sons, New York. Size 4½x7 in., pp., 166. Price $2.50.

THIS book, now in its third edition, has been standard since its first appearance in 1908, when it was written by the late Dr. Hayes. Members of the Geological Survey had for a long time needed a convenient and concise description of geologic field methods, and this work was written in response to this demand. While the Survey Handbook has been used in its preparation, those instructions which apply only to members of the Survey have been omitted and those features enlarged upon which will serve students in preparing for work in field geology.

While many of the suggestions may be thought too elementary, the author says it is his experience that mistakes in simple matters are by no means confined to beginners. All are urged to be cautious in abusing the book. Directions for making and recording observations and for using the schedules are intended to insure thoroughness and system—not to relieve the observer for the necessity for thought. The handbook is not a prospector's guide or a treatise on economic geology.

This edition has been revised and rearranged by Sidney Page, geologist in charge, Division of Geology, United States Geological Survey, without altering the fundamental plan of the book. A brief mineralogy has been prepared by Dr. E. S. Larsen, of the Survey, and new tables for useful calculations in stratigraphy are also added. The book is compact, valuable and accurate and the fact that this is the third edition is ample evidence of its usefulness in its field.

"Dynamite, the New Aladdin's Lamp," is a very attractive specimen of the printer's art. This little book is printed on common gray wrapping paper, having a cover of light brown, with a decorative title page in red and black and small cuts showing antique lamps surrounding a larger design in the center. The pages are tastefully ornamented with bold initial-letters in red illuminating the text, and delicate pen-and-ink sketches accentuate the points made by the author in his contention that dynamite is truly the new Aladdin's lamp.

Throughout, the story is made appropriate to its title by the author. He is T. W. Bacchus, vice-president of the Hercules Powder Co. Mr. Bacchus has ably and interestingly set forth that, like this fabled lamp, dynamite also does the bidding of man and causes Nature's vast stores to yield their treasures.

After a review of what dynamite has accomplished to develop Mother Earth's resources, Mr. Bacchus tells us what wonderful strides mining has made through the agency of this explosive; how the systems of transportation, the highways, the railroads, and the waterways, are now serving commerce and the industries; what they all mean to the manufacturer, the farmer and the public.

"The art of mining gold, silver, iron and copper," says the author, "was known as far back as the days of Job and King Solomon. The steam engine is an ancient invention, having been used in 130 B. C. As iron, copper, and steam are among the most important elements of our material success today, how does it happen that we had to wait thousands of years for their full development? What caused a hiatus that historians too often fail to see or for which they do not offer a solution?

"It is explainable: Because without high explosives the amount of iron that could be obtained was extremely limited. This is also true of copper. The steam engine could not be fully developed and exploited without unlimited quantities of iron and copper and unlimited fuel for the generation of steam. It will be seen, therefore, that they all awaited the arrival of the superforce, dynamite, the greatest boon that has ever been created for overcoming the obstacles in nature, and the masterpiece of the chemist's art."

Hints and Helps for Superintendents

How to Splice Wire Rope

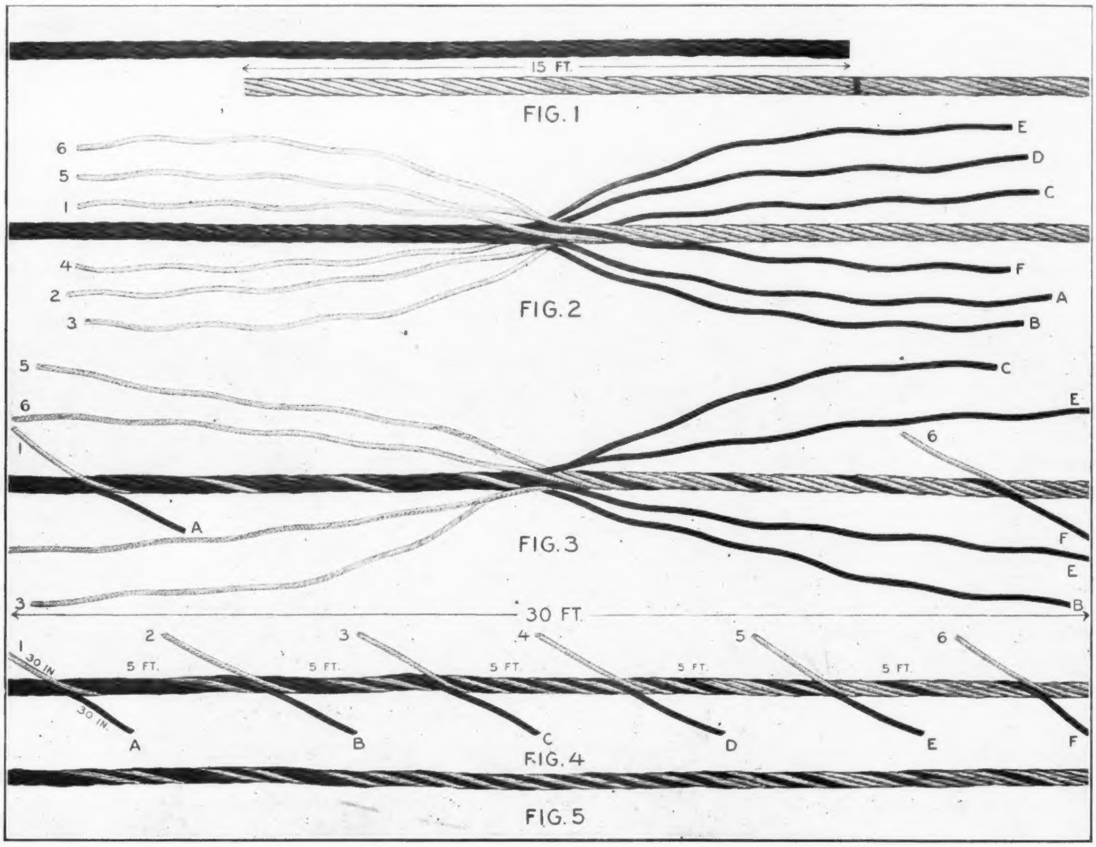
THE splices for running rope are of the kind known as the long splice and should be put in from 20 to 60 ft. in length, depending upon the size of the rope and the condition of the work. The diameter is not altered nor the rope strength perceptibly weakened.

A pair of nippers or a hammer and a sharp chisel for cutting off the ends of the strands are among the tools necessary to do the work; also a steel point or marlinspike for opening the strands; two pieces of heavy tarred marline or thin required 15 ft. of additional rope at both ends.

Second—Unlay the strands of both ends of the rope for a distance of 15 ft. each. Next cut off the hemp cores close up, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other. (Fig. 2.)

Third—Unlay any strand and follow up closely with one strand of the other end, laying it tightly in the open groove made by unwinding the first strand; make a twist of the strand agree exactly end and follow with strand *F*, laying it in open groove as before, and treating this precisely as in the first case, as in Fig. 3. Next, pursue the same course with *B* and 2, stopping 5 ft. short of the first set and cut off strands so as to have an end to each of about 30 in. long. (See Fig. 3.) Next, with 5 and *E*, stopping as before; then with *C* and 3; and lastly with 4 and *D*. The strands are now laid in with ends 5 ft. apart, as in Fig. 4.

Fifth—The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps and fasten



How to make a wire-rope splice 30 ft. long. When a splice of a different length is to be made, use proportionate dimensions

rope with sticks for untwisting rope; a pocket knife for cutting the hemp core; and two wooden mallets or a pair of 2-lb. copper mallets.

Here are the directions for making a 30-ft. splice:

First—Carefully measure the length the rope should be after splicing, keeping in mind that for a 30-ft. splice there will be with the twist of the open groove. Proceed with this until all but 30 in. of strand are laid in. Next cut off the first strand, leaving an end of equal length to the end of strand 1, or about 30 in. long (Fig. 3.) A good rule is to make these ends equal to 1/12 the total length of the splice.

Fourth—Unlay strand 6 of the opposite them on each side of a point where two strands intersect (Fig. 6); twist them in opposite directions so as to open up the lay of the rope sufficiently to cut the hemp core at the point of intersection. Pull out the hemp core to the right for a short distance. Drive the marlinspike under a strand (Fig. 7); and after straightening out the end of strand *A*,

begin to work it into space previously occupied by the hemp core. Rotate the marlinspike so as to open up the rope further to the right; continue to pull out the hemp core and to work in strand *A* until all of it is in the center of the rope. Cut off the hemp core where the strand ends, and push the end of the core back into its place. Next draw out the hemp core to the left and lay the end of strand 1 into same manner. The two ends should be laid in side by side—not crossed over each other.

Shift the clamps to the next intersection of strands and repeat the operation, and so on until all the ends are inside the rope. At the points where the tucks

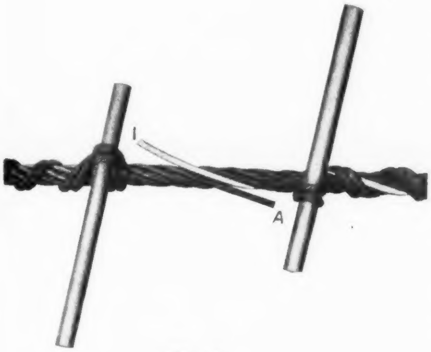


Fig. 6

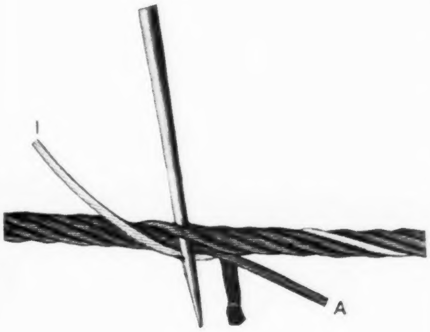


Fig. 7

Fig. 8—The completed tuck before being hammered into shape

are made, hammer lightly with a copper or wooden mallet so as to fix the strands firmly in place.

When splicing rope which is to run over small sheaves or subjected to excessive strains, wrap the end of each strand for the distance that is to be tucked into the center of the rope with tarred marline or electrician's tape, this will increase the friction and prevent the ends from working out. In splicing Lang's Lay wire rope it is advisable to make a longer splice than for the same size rope of regular lay.

The patent flattened strand splice is no more difficult and is equally as effective as the round strand cable. The length of splice should be longer than for the same size round strand rope. The method of making this splice is otherwise identical up to the point of tucking in the ends of the strand. A slightly different treatment is required in this operation, due to the ratio in the size between the strands and the hemp core.

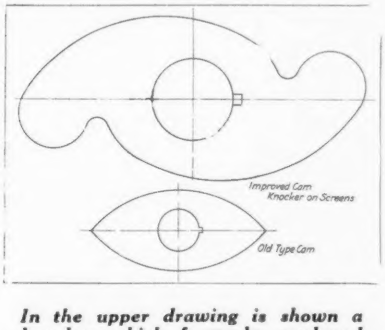
Straighten out the ends of the strands by eliminating as much of the spiral form as possible. The entire length of each strand end is then wrapped with insulating tape, tarred marline or strips of burlap, until its diameter is slightly in excess of that of the hemp core. The tuck is then made similar to that of the round strand splice.

In styles A and C of the patent flattened strand construction, it is necessary to turn the strand sideways at the point where it passes to the center of the cable, thereby preventing a bulge in the cable. In case of ropes having five strands, the odd truck is made at the center of the splice. Where an endless rope cannot be put on, the rope must be placed around the sheaves, drawn tight with tackle blocks and the splices made on the sport.

The A. Lescher & Sons Rope Co., St. Louis, is the authority for this method of splicing wire rope.

Improved Knocker for Vibrating Screens

AT the plant of the Linwood Stone and Cement Co., Linwood, Iowa, quite a few vibrating screens are employed for the separation of the finer



In the upper drawing is shown a knocker which formerly produced the vibration. In the lower drawing is the improved knocker

stone. When the plant first started up a knocker to produce the vibration was used such as is shown in the lower portion of the accompanying drawing. This type of knocker or cam had a tendency to wear out at the point of contact and in no case did it last over one month.

As this proved to be a considerable source of trouble an improved type of knocker, such as is shown in the upper portion of the drawing, was designed. This type of cam, as can be readily seen, is rounded at the points where it makes contact with the screen and it has been found that the life of this cam lasts for a period of seven months and gives better results than the type formerly used.

The cam is 4-in. wide and is made of cast iron. J. A. Thiessen is superintendent of this plant.

One-Man or Two-Man Riprap?

IT has been stated by J. F. Schroeder, general manager of the Linwood Stone and Cement Co., of Davenport, Iowa, that "We have some trouble with a railroad engineer as to what constitutes one-man and two-man riprap. We have been shipping riprap for 10 years and never had trouble as to grading of sizes until this time. All engineers accept our two-man riprap except this one who claims our two-man is not the proper size for two-man riprap. We contend that two-man riprap is the same as one-man, except that two-man contains all pieces large enough so that two men can handle it and from this size down to spalls, while one-man contains nothing larger than what one man can handle down to spalls. Hereafter we will accept orders from railroad companies on Standard specifications. We cannot afford to pay freight and have the material refused when confident that we are not at fault."

The Secretary of the National Crushed Stone Association has advised Mr. Schroeder as follows: "We have queried quarrymen who advise that to their knowledge there are no standard riprap specifications. The size of these two styles of stone seems to be one-man or two-man power to handle. Some quarrymen advise that when they furnish riprap to railroads for washout or levy purposes they insist on the railroad or purchaser sending representative to the quarry to designate what is desired. We are writing the U. S. Bureau of Standards, to advise whether it has provided printed standard riprap specifications. Upon receipt of reply will forward its reply to you."

Another Shope Concrete Brick Plant

AT Las Cruces, N. M., a permit was recently granted the Shope Concrete Brick Co. of that city to operate. This company has been capitalized at $30,000. The headquarters of this company has been established at El Paso, Texas.

Quarried from Life

By Liman Sandrock

Ex-President Krause, Gentlemen!

Wise old Cervantes, in his "Don Quixote," had this to say: "You are a devil at anything, and there is no kind of thing in the 'versal world but what you can turn your hand to."

WITH the most of us, if we owned and operated five or six quarries in one state alone; had a whole town named for us; were in the coal business, owning the mines, and foresaw the development of a huge steel industry in their midst; if we sold Fords and Lincolns on the Boul' Mich in Chicago, grew oranges in Alabam', and operated the largest dairy and hawg farm in Illinoy— Say, wouldn't we agree with ol' Doc Cervantes that we were the very "devil at anything"?

Well, all this, and more, has been accomplished in one lively lifetime by E. J. Krause, whose name is unostentatiously placed on the letterhead of the Columbia Quarry Co., of St. Louis, as "vice-prest & treas" and engraved on the hearts of his many friends in the industry as a fine friend and a he-man!

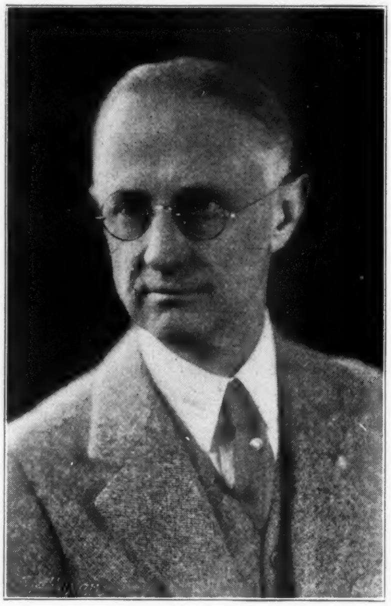
And yet he told me recently: "Frankly, I don't know anything that would make a pen-picture of myself." Rather a modest statement from a man whose life has been big with achievement and one gifted with wide vision for the future of the rock products industry, don't you think?

Consider his keen foresight in going to the quarry business. His coal trade was active only during the winter months; the quarry business was active during the summer. Now, Mr. Krause is an all-the-year-round business man and early in life must have adopted Washington's maximum: "A slender acquaintance with the world must convince every man that actions, not words, are the true criterion of the attachment of friends; and that the most liberal professions of good-will are very far from being the surest marks of it."

And so, when he foresaw the development of the steel industry in his section, and prepared for it, he was justified when the St. Louis Coke and Chemical Co., erected its blast furnace. This company makes metallurgical coke out of Illinois coal. Some 50 per cent of its iron ore comes from Missouri, and certainly it is in line to get the tremendous business of the Southwest by reason of the lower freight rates.

One quarry alone of the Columbia company produces 2500 tons a day—and the town in which this quarry is situated is called Krause!

Then there is the Horticultural Development Co., of St. Louis, in which Mr. Krause shares with his brother, C. H. Krause, the control and direction. And they grow Satsuma oranges "down



E. J. Krause of the Columbia Quarry Co.

in the heart of the Empire of Flowers," in historic Mobile country, Alabama—and they cultivate more than 600 acres. It would make your mouth water just to read the description in one of the company booklets of how this citrous delicacy is raised.

It's a far cry from crushed stone and oranges to cows and sows. But the same indomitable energy has gone into the breeding of cows and sows as in crushed stone, coal, and oranges. Mr. Krause is justly proud of one cow in particular, for this lady has won the state record—a record of from 1 to 70 days—and her milk has, bless her copious udder, taken either a cup or a medal every time her lacteal fluid has been entered in competition. And the sow? She, too, is a champion—for other and perfectly obvious reasons. Without doubt, Mr. Krause is versatile in his varied and successful endeavors.

In 1921, at the Toronto convention of the National Crushed Stone Association, he was elected its president and served for that year. He was unable to attend any of the sessions of the Chicago meeting last January because of the death of his daughter.

His letter at that time, read in open meeting, was a careful analysis of the coal situation and its relation to the quarry industry. Here again his keen foresight came into play, for he prophesied the strike in the bituminous mines and urged the use of cars early in the year "because there will be a shortage as the season develops."

His heart was with us at this Chicago convention, for he gave a dinner to all the crushed stone men attending the convention. During the festivities a moment was spared to expressing our sympathy to him in his bereavement and a tribute paid to his kindly thoughtfulness for the members of the association in which he was the president.

The industry at large is proud of Mr. Krause and his work for the good of the order, and we know that he in turn is equally proud of us.

An S-O-S Appeal

WHILE we "lay not flattering unction to our soul," at the same time we must say that our many friends tell us they are pleased with what we have so far been able to quarry from life in the industry. And we are duly grateful.

But, we know that this page would be much more attractive and interesting if we could get your co-operation in the operation of this quarry. We've tried to keep it screened and clean, dewatered and not overburdened with unnecessary equipment, but, gosh! we don't want to resort to the thousand-foot level to get our oil.

There's surface material aplenty that YOU know of—peppy, kindly, friendly incidents about yourself or your brothers in this industry that we will be glad to broadcast PDQ to all our readers.

This is an SOS appeal. Will you flash us that you're coming to our aid? And do it the well-known NOW?

They Said It

JAMES SAVAGE of the Buffalo Crushed Stone Co. has some Canadian gold mine claims. And we have his promise to visit them some time. Golconda, we'll be there!

T. E. MCGRATH of the McGrath Sand and Gravel Co. says: "The reason why a sand man does not need a vacation in the summertime is that a man with plenty of sand, a wide horizon, and a cool head is a summer resort all in himself."

THE FOREMAN at the kiln to the new hand: "Yer hopeless. I've teached ye all I know, an' still ye don't know anything."

Editorial Comment

"In Time of Peace—"

"In time of peace prepare for war." While the federal government does not indicate by its present military policy a very strong belief in this old adage, the saying is one that producers of rock products can well take to heart in the present national emergency. Indeed, the time to prepare, in the sense of preparation for that which may come, is already past because the emergency is already here.

Conditions of industrial war exist on two big fronts, and whether or not the latest governmental efforts will be effective in shortening either coal or railroad strike, the serious effects of those two strikes will just commence to make themselves felt.

Coal surpluses which have kept cement, lime, gypsum and other industries growing are getting dangerously low, and the need for winter coal in the north would easily take all the available coal produced for several weeks. The starting once more of car priorities means few and delayed shipments for the rail shipper of gravel, stone, and other products. Nothing can happen, evidently, to relieve the situation for rock products producers immediately, nor within several weeks to give them the conditions they may reasonably expect to enjoy in "normal" times—if there are any such.

Conditions are going to be difficult—serious, even—for rock products men, and the wise producer is laying plans to meet as best he can conditions as he expects to find them. The period to come is one when the present "marginal producer" of the economist, the man who is just getting by under present conditions, will have to give up the ghost and leave the race to his stronger competitors.

No one wants to be in this class, and there is still time for preparation which will bring greater profit or smaller loss to the strong producer, and even save the weaker one from ruin. To the resourceful manager a study of conditions present and expected for the future will reveal many steps to be taken as emergency acts which will help to maintain production or shipments.

Just what to do will depend on local conditions. It may be to locate small private surpluses of coal here and there within economical hauling distance and at not unreasonable prices. It may be to extend the radius of truck delivery and increase his delivery capacity by borrowed or hired trucks, or by extra drivers and 24-hour shifts for the trucks. It may be any one or several of a hundred things.

Whatever it is he does, it is the manager who anticipates the conditions before they arrive and lays plans for meeting them who will pull through safely in times like those ahead.

A Ray of Hope

One hopeful sign has developed in the national emergency resulting from the coal and railroad strike situations. That is that Herbert Hoover will supervise the emergency program of the country as chairman of a committee composed of a commissioner of the Interstate Commerce Commission, and the cabinet heads of the Department of Commerce, the Department of Justice, and the Department of the Interior.

Mr. Hoover is an engineer, a practical man, and one who sees a situation from the point of view of the business men of the country. He has specialized for more than a year now in getting the business man's point of view and any action carried on under his direction may be expected to be practical and not political.

Whatever action will be for the public good, the present Secretary of Commerce may be expected to take, but at the same time he will not forget private interests where they can be as readily served without affecting the public good. If any producer or shipper, or any class of producers or shippers, can convince a committee of which Mr. Hoover is chairman that unjust, unreasonable, and unnecessary discriminations are in effect, it is a pretty safe bet that they will cease.

Breakdown Insurance.

Have you ever stopped to figure out the cost of a half day's delay when your plant has to be stopped for repairs or the replacement of some vital part? Idle men, idle machinery, confusion, orders lost through delay quickly mean a large loss. Such delays always come at the busiest seasons, and no plant can be wholly without them, but good management will see that everything is provided to make the delays a minimum when some break occurs. If half an hour will start the plant running again where it might have taken two hours, then 75 per cent of the delay has been eliminated.

Delays from breakdowns are best avoided in the original design and construction of the plant. A flexible plant where the important units are duplicated, and where the whole is strongly constructed, is least likely to be troubled with delays.

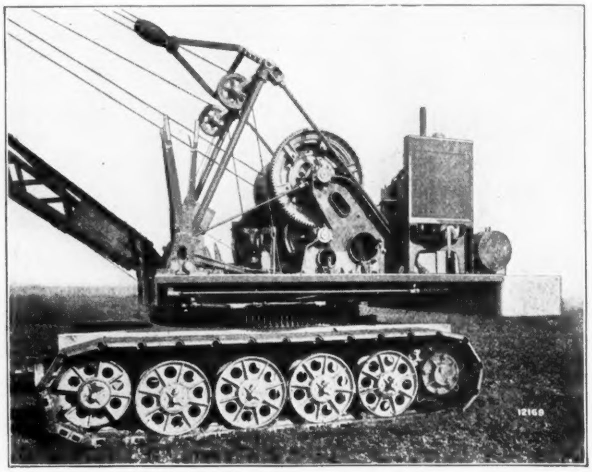
The best insurance for this purpose is a complete stock of spare equipment, parts, and supplies. Most plants are located a considerable distance from the nearest source of supply, and the lack even of a bolt has often meant several hours in locating the right one and getting the plant started again.

One sand and gravel producer has almost a duplicate plant in his storerooms. Even his main motor—a 250 hp. one—could not stop his plant long by breaking down, because he has a brand new one ready to put in.

New Machinery and Equipment

New Crawler Crane

THE crawler crane shown in the illustration and which embodies a number of new features has been placed on the market by the Link-Belt Co., Chicago. Without bucket the machine weighs 22 tons, making a ground pressure of 10 lb. per sq. in. and it is rated to lift 10 tons at 12 ft. radius and three tons at 30 ft. radius. The hoisting speed is 125 ft. per min. with a maximum rope pull of 10,000 lb. on a single line. The machine is suitable for both clam-shell and drag-line bucket work, having two independent band-clutch operated hoisting drums. The crane will rotate four times a minute, travel 3/4 mile per hour and climb a 20 per cent grade.



Crawler crane rated to lift 10 tons at 12-ft. radius and 3 tons at 30-ft. radius

The shoes are 18 in. wide, of 12 in. pitch, and made of one-piece high-carbon chrome steel castings with machined holes for 1¾-in. diameter high-carbon pins. There are eight bronze-bushed crawler rollers, 25 in. in diameter. The overall width of the crawler tread is 9 ft. 7 in., and the distance from center to center of the sprockets, lengthwise, is 10 ft., giving a bearing area of 30 sq. ft. The lower frame is a one-piece annealed open-hearth steel casting designed to carry the severe diagonal stresses of a machine of this type.

A hollow cast-steel dead axle housing has been provided on which the load carrying sprockets are mounted and inside of which the floating drive axles are located, cut bevel gearing running in oil being used. The control clutch steering the caterpillar, is also placed inside the housing and is in constant connection with a foot lever on the operator's platform, and can be used in any position of the rotating base. The foot lever also instantly locks the caterpillar, so that the crane can be operated on an incline without resorting to blocking. The bevel gearing underneath the frame, connecting the vertical travel shaft with the longitudinal rear axle countershaft, is also inclosed in a cast-steel casing, the gears running in a bath of oil.

The rotation gear, roller path and center casting form a single steel casting 7 ft. in diameter, the large size of which is intended to keep the center of gravity of the rotating frame within the roller race, thereby materially reducing the stresses in the center pin and rotating mechanism. The upper rotating frame, a single-piece annealed open-hearth steel casting, 14 ft. long, 5 ft. wide, and 11 in. deep, rotates on four 12-in. diameter, 4-in. face finished and bronze-bushed conical steel rollers, and is held to the lower frame by a finished forged steel center pin.

The machine is driven by a Climax Engineering Co., four-cylinder, heavy-duty tractor engine with a gasoline tank of 30-gal. capacity, or enough for about 15 hr. continuous operation. A 40 hp. electric motor can be provided instead of the gasoline motor, if required. All gears with the exception of the rotation gear and pinion, have machined teeth. There are only three bevel gears on the rotating frame and only 16 gears of all descriptions in the entire crane.

The reversing friction clutches for swinging, traveling and boom hoisting are of the expanding type and may be applied with a minimum of effort. The boom hoisting mechanism is automatically self-locking. The brake drums are mounted on extended hubs of their respective rope drums and connected with them by means of ratchet and pawl mechanism. The operator can set his brakes either before or while hoisting his load, so that the moment he pulls his hoist clutch out of engagement his load is automatically held in position. This permits a less skilled operator to run the crane. It requires dexterity to manipulate clutch and brakes simultaneously.

The boom is 35 ft. long and of angle and lattice bar construction, parabolic in shape

The construction of the crane is such that all of the machinery may be inclosed. Inside the housing there is an unobstructed platform, 30 in. wide the full length on each side of the rotating base so that the machinery is easily accessible. The machinery may be dismantled without disturbing the house. All necessary attachments for hook block, grab bucket, dragline bucket, pile driver and magnet up to 45 in. in diameter, are included in the equipment.

Accident Prevention

Safety by Use of Compressed Air Machinery and Equipment—III

IN SOME installations fusible plugs are in the bonnets or other metallic parts of the air discharge valves or pipes. These plugs may act as whistle warnings or they may be arranged to relieve the air pressure automatically in case the temperature of the compressed air exceeds a certain maximum—perhaps fixed at 350 or 500 deg. F., depending upon the size and type of the compressor used.

It is advisable to draw into the compressor air that is as cool as possible. The cooler the air at intake, the lower will be its temperature when compressed, thus reducing correspondingly the danger of fire or explosion. It is obviously unadvisable to locate the intake in the boiler room or in any other place where the air is hotter than the outside atmosphere.

Cooling Air Between Stages and After Compression—In some installations, particularly if the air is to be compressed to 75 lb. pressure or more, it may be desirable to operate two-stage compressors. A two-stage unit makes it possible to operate an inter-cooler to cool the air between the first compression which raises the pressure of the air from that of the atmosphere to approximately 30 lb. and the second compression which raises the pressure of the air from 30 to 100 lb. or to pressure capacity of the machine. Compressing the air to 100 lb. pressure may raise its temperature to 480 deg. F.

Many installations provide special apparatus for cooling the air after compression. This prevents further vaporization and carbonization of the particles of lubricating oil carried over from the air cylinder, it tends to condense some of the oil that has already vaporized, and also condenses much of the water vapor contained in the compressed air. For similar reasons it is advisable to keep the compressed air receiver in a cool rather than in a hot place. Moisture in compressed air has little or no effect upon the danger of fire or explosion, but it is objectionable because of its corrosive action upon the pneumatic tools and other parts of the compressed air system, because it may cause water hammer in the piping, and because it increases the possibility of freezing the pipe lines and the machine exhausts in cold weather.

Air Receivers

Air tanks or receivers should be made of boiler plate as specified in the A. S. M. E. Boiler Code, copies of which can be secured from the American Society of Mechanical Engineers, 29 West Thirty-Ninth street, New York City. As soon as the code on Unfired Pressure Vessels is printed, it should be used in this connection instead of the boiler code. If there are state or local requirements for construction and operation, these too must be followed.

In some places, particularly small garages, household hot-water tanks are used as air receivers. Such tanks are not built according to boiler specifications and it is therefore dangerous to use them for this purpose.

The maximum allowable working pressure of an air receiver depends upon the thickness and tensile strength of the metal, the efficiency of the joints, the dimensions of the receiver, and the factor of safety employed, as specified in the code. No air receiver should be operated at a pressure higher than the maximum allowable working pressure except when the safety valve or valves are blowing at which time the maximum allowable working pressure should not be exceeded by more than 6 per cent.

Each air tank should be conveniently located near the floor or a platform so that it can be inspected easily on all sides. Under no circumstances should a tank be buried underground or located in any other inaccessible place.

A drain pipe and valve should be installed at the lowest point of every air tank to remove all accumulated oil and water. This valve should be opened and the tank drained at regular and frequent intervals. If allowed to remain in the tank, this oil and water may freeze; they also reduce the available air volume, corrode the air tank and other equipment, and increase the danger of explosion.

If possible, the pipe between the compressor and receiver should be installed without stop valves. Such valves may be necessary, however, where more than one compressor is connected to the same tank. If used, stop valves should be of the gate or straightway types—not of the globe type. In every case where a stop valve is installed, a spring pop safety valve should be provided between the compressor and the valve. This safety valve should be set to blow at a pressure a little higher than the blowing pressure of the safety valve on the air tank.

Failure to provide a safety valve in this line might result in a cylinder head being blown off.

Under no circumstances should an air receiver be installed without a pressure gage and a spring pop safety valve. The size of this safety valve should be proportional to the capacity of the compressor and as already specified, it should never allow the pressure in the tank to exceed the maximum allowable working pressure of the tank by more than 6 per cent. The value should be tested from time to time to see that it is in good operating condition. If the tank is located outside, the valve should have a hood over it to protect it against the weather.

Explosion Hazards

The exact causes of explosions in air compressors, receivers, and pipes are not thoroughly understood, but enough is known to make the best authorities recommend that special attention be given to compressor lubrication, cleanliness of the air at intake, air cylinder temperature, and cooling the air between stages and after compression.

(Concluded)

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	....
Buffalo, N. Y.	1.30 per net ton all sizes					
Chaumont, N. Y.	1.00	....	1.50	1.25	1.25	1.25
Cobleskill, N. Y.	....	1.25	1.25	1.25	1.25	1.25
Coldwater, N. Y.	1.50 per net ton all sizes; fluxing stone 1.80 per ton					
Eastern Penna.	1.35	1.35	1.35	1.35	1.35	1.35
Munnsville, N. Y.	.50	1.25	1.25	1.15	1.15	....
Prospect, N. Y.	.75	1.25	1.25	1.25	1.25	....
Walford, Pa.	....	1.30	1.30	1.30	1.30	1.30
Western New York	1.00	1.20	1.20	1.20	1.20	1.20
Westfield, Mass.	....	.60	1.35	1.25	1.10	1.00
CENTRAL						
Alton, Ill.	1.75	....	1.40	1.35	1.35	....
Buffalo, Iowa	.90	....	1.20	1.00	1.05	1.05
Chicago, Ill.	1.20	1.60	1.20	1.20	1.20	1.20
Dundas, Ont.	1.00	1.35	1.35	1.25	1.10	1.10
Faribault, Minn.	....	....	....	....	1.75	....
Greencastle, Ind.	1.00	1.00	1.00	.90	.90	.90
Illinois, Southern	1.75	1.60	1.50	1.50	1.40	....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.50
Krause or Columbia, Ill.	1.40	1.20	1.35	1.20	1.20	1.20
Lannon, Wis.	.85	....	.95	....	.85	.85
Mitchell, Ind.	.80	.80	.80	.80	.80	.80
Montreal, Canada	.85	1.20	1.10	1.05	1.00	....
Montrose, Ia.	....	1.50	1.60	1.55	1.45	1.40
River Rouge, Mich.	1.00	1.10	1.10	1.10	1.10	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	....
Southern Illinois	1.30	1.30	1.30	1.25	1.20	....
Stolle, Ill. (I. C. R. R.)	1.30	....	1.35	1.35	1.35	1.35
Stone City, Iowa	....	....	1.40	1.30	1.25	....
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Waukesha, Wis.	Prices include 90c freight all sizes .80 per ton					
SOUTHERN:						
Alderson, W. Va.	1.10	1.35	1.65	1.35	1.35	....
Bromide, Okla.	1.50	....	....	1.50	1.50	....
Cartersville, Ga.	....	2.00	1.40	1.25	1.25	....
Chickamauga, Tenn.	.90	1.00	1.00	1.00	.90	....
Dallas, Texas	1.00	1.00	1.00	1.00	1.00	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	....	....
Ft. Springs, W. Va.	1.00	1.30	1.40	1.25	1.15	....
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	....
Ladds, Ga.	2.00	2.00	2.00	1.50	1.50	1.50
Morris Spur (near Dallas) Tex.	1.00	1.25	1.25	1.25	1.25	1.00
WESTERN:						
Atchison, Kans.	.90	1.80	1.80	1.80	1.80	1.80
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.55	1.45	1.40
Cape Girardeau, Mo.	1.50	....	1.50	1.50	1.25	....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.40

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Bernardsville, N. J.	2.00	2 20	2.00	1.80	1.50	....
Branford, Conn.	.60	1.50	1.25	1.15	1.00	....
Bound Brook, N. J.	1.80	2.30	1.90	1.50	1.40	....
Dresser Jct., Wis.	1.25	2.25	2.25	2.00	1.50	....
Duluth, Minn.	.90@1.00	2.25	1.90@2.00	1.40@1.50	1.30@1.40	1.50
E. Summit, N. J.	2.10	2.30	2.00	1.70	1.40	1.50
Eastern Mass.	.60	1.85	1.60	1.50	1.50	....
Eastern New York	.75	1.60	1.60	1.40	1.50	1.50
Eastern Penna.	1.25	1.70	1.60	1.50	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.50	1.25	1.15	1.00	....
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	1.75
Richmond, Calif.	.50*	....	1.75*	1.50*	1.50*	....
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Springfield, N. J.	1.75	2.10	1.80	1.75	1.60	1.60
Westfield, Mass.	.60	1.35	1.25	1.10	1.00	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Columbia, S. C.—Granite	....	....	1.75@2.00	1.75	1.60@1.75	....
Dundas, Ont.—Flint	1.00	1.50	1.50	1.50	1.25	1.20
Eastern Penna.—Sandstone	.85	1.60	1.55	1.40	1.35	1.35
Eastern Penna.—Quartzite	1.20	1.35	1.20	1.20	1.30	1.30
Ft. Springs, W. Va.—Granite	1.00	1.25	1.40	1.25	1.20	....
Lithonia, Ga.—Granite	1.00	....	1.50	1.25	1.25	1.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30	....	1.20	....
Los Angeles, Calif.—Granite	....	1.25@1.50	1.15@1.40	1.15@1.40	....	....
Macon, Ga.—Granite	.50	....	2.50	2.25	2.00	1.25@1.90
Middlebrook, Mo.—Granite	3.00@4.00	....	7.00@7.25	2.00@2.25	....	1.25@1.75
Sioux Falls, S. D.—Granite	.75	1.85	1.75	1.70	1.70	....

*Cubic yard. †Agrl. lime. ||R. R. ballast. §Flux. ‡Rip-rap, a 3-inch and less.

Agricultural Limestone

EASTERN:	
Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk	2.50
Grove City, Pa. — Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$—100% thru 20 mesh, 60% thru 100 mesh, 40% thru 200 mesh; in 80 lb. paper sacks, 4.50; bulk	3.00
Hillsville, Pa. — Analysis, 96.25% $CaCO_3$—Raw ground; sacks, 4.50; bulk	3.00
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$, 5.25% $MgCO_3$; sacks, 4.00; bulk	2.50
New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk	3.00
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk	3.00
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.25—cloth, 4.75; bulk	3.00
Williamsport, Pa. — Analysis, 90% $CaCO_3$, 2% $MgCO_3$—50% thru 50 mesh; paper, 4.75; bulk	3.75
CENTRAL:	
Alton, Ill.—Analysis, 97% $CaCO_3$, 0.1% $MgCO_3$—90% thru 100 mesh	6.00
Bedford, Ind. — Analysis, 98.5% $CaCO_3$, .5% $MgCO_3$—90% thru 10 mesh	1.50
Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Bellevue, Ohio — Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh	1.25
Bettendorf, Ia., and Moline, Ill.—98% $CaCO_3$, 1% $MgCO_3$—50% thru 100 mesh; 50% thru 4 mesh	1.11
Buffalo, Ia.—90% thru 4 mesh	1.00
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.3% $MgCO_3$—50% thru 100 mesh	1.50
90% thru 4 mesh, cu. yd.	1.35
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh	**1 00**
Columbia, Ill., near East St. Louis—⅛-in. down	1.25@1.80
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$—50% thru 50 mesh	1.25
Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh	2.00
Kansas City, Mo.—50% thru 100 mesh	1.50
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh	1.40
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—90% thru 50 mesh	2.00
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$—50% thru 100 mesh; bags, 4.50; bulk	3.00
90% thru 4 mesh	1.25
Milltown, Ind. — Analysis, 94.41% $CaCO_3$, 2.95% $MgCO_3$—40.8% thru 100 mesh, 61.2% thru 50 mesh	1.40@1.50
Mitchell, Ind. — Analysis, 97.65% $CaCO_3$, 1.76% $MgCO_3$ — 90% thru 100 mesh	1.25
Montrose, Ia.—90% thru 100 mesh	1.25
Narlo, Ohio—Analysis 56% $CaCO_3$, 43% $MgCO_3$, limestone screenings, 37% thru 100 mesh; 55% thru 50 mesh; 100% thru 4 mesh	1.50@2.00
Ohio (different points), 20% thru 100 mesh; bulk	1 25@1.50
Piqua, O.—90% thru 100	3.25@5.00
40% thru 100	1.75@2.00
100% thru 4	1.25
River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ⅛-in. mesh	1.30
Stone City, Ia.—Analysis, 98% $CaCO_3$, 50% thru 30 mesh	.75

(Continued on next page)

Agricultural Limestone

(Continued from preceding page.)

Toledo, Ohio—¼-in. to dust, 20% thru 100 mesh	1.50
Waukesha, Wis.—No. 1 kiln dried	2.00
No. 2 Natural	1.75
Chasco, Ill.—Analysis, 96.12% $CaCO_3$, 2.5% $MgCO_3$—90% thru 100 mesh	5.00
90% thru 50 mesh	1.35
Yellow Springs, Ohio—Aanlysis 96.08% $CaCO_3$, 63% $MgCO_3$, 32% thru 100 mesh; 95.57%, sacked, 6.00; bulk	4.25
SOUTHERN:	
Alderson, W. Va.—90% thru 50 mesh	1.50
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$ — 50% thru 100 mesh	2.00
90% thru 4 mesh	1.50
Cartersville, Ga.—Analysis, 55% $CaCO_3$, 42% $MgCO_3$—all passing 10 mesh	2.00
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$—90% thru 100 mesh, 4.00; 50% thru 100 mesh, 3.00; 90% thru 50 mesh, 3.00; 50% thru 50 mesh, 2.75; 90% thru 4 mesh, 2.75; 50% thru 4 mesh	2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$—90% thru 50 mesh	1.75
Hot Springs, N. C.—90% thru 100 mesh, sacks, 4.25; bulk	3.00
Knoxville, Tenn.—Pulverized	2.50
90% thru 100 mesh	2.70
100% thru 20 mesh	2.30
Ladds, Ga.—90% thru 50 mesh	2.00
Linnville Falls, N. C.—Analysis, 53% $CaCO_3$; 42% $MgCO_3$—50% thru 100 mesh; 2.50 per ton bulk, 3.50 per ton mesh 200-lb. burlap; crushed limestone, ⅜ down, including dust, 1.00; 1 to ⅜, 1.60; 2-in. and less	1.40
Mountville, Va. — Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—X thru 20 mesh; sacks	5.00
WESTERN:	
Colton, Calif.—Analysis, 95% $CaCO_3$, 2-4% $MgCO_3$—all thru 14 mesh—bulk	4.00
Garnett, Okla.—Analysis, 86% $CaCO_3$, 50% thru 4 mesh	.50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk	1.80
Tulsa, Okla.—90% thru 4 mesh	.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:	
Baltimore, Md.	2.25
Berkley Springs, W. Va.	1.75@2.00
Cedarville and South Vineland, N. J.—Damp, 1.75; dry	2.25
Cheshire, Mass.	5.00@8.00
Columbus, Ohio—Glass sand	1.25
Dunbar, Pa.—Damp	2.00
Falls Creek, Pa.	2.50
Hancock, Md.—Damp	1.25@1.75
Klondike and Pacific, Mo.	1.75@2.50
Mapleton, Pa.	2.00@2.75
Massillon, Ohio	3.00
Michigan City, Ind.—Glass sand	.40@ .45
Mineral Ridge, O.	2.50
Green	2.25
Montoursville, Pa.	1.75
Oregon, Ill.—Glass sand	.75
Ottawa, Ill.	.75
Pittsburgh, Pa.—Dry, 4.00; damp	3.00
Rockwood, Mich.	2.50
Round Top, Md.—Dry	1.25
San Francisco, Cal.	3.00@3.50
St. Mary's, Pa.	2.25
Thayers, Pa.	2.00
Utica, Ill.	1.00@1.25
Zanesville, Ohio	2.00@2.50
FOUNDRY SAND:	
Albany, N. Y.—Sand blast	4.00
Molding fine and brass molding	2.00
Molding coarse	1.75
Allentown, Pa.—Core and molding fine	1.50@1.75
Arenzville, Ill.—Molding fine	1.20@1.60
Beach City, O. — Core, washed and screened	2.00@2.50
Furnace lining	2.50@3.00
Molding fine and coarse	2.25@2.50
Cheshire, Mass.—Furnace lining, molding, fine and coarse	5.00
Sand blast	5.00@8.00
Stone sawing	6.00
Cleveland, O.—Molding coarse	1.50@2.00
Brass molding	1.50@2.00
Molding fine	1.50@2.25
Core	1.25@1.50
Columbus, O.—Core	.30@1.75
Sand blast	3.50@5.00
Furnace Lining	1.50
Molding fine	2.00
Molding coarse	1.75
Stone sawing	1.25
Traction	.75
Brass molding	2.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Attica, N. Y.	.75	.75	.75	.60	.60	.60
Ambridge and So. Heights, Pa.	1.15	1.15	1.15	1.15	.70	.70
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.	1.00		1.00		1.25	
Farmingdale, N. J.	.48	.48	1.00	1.00	1.20	
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.50	1.75	1.35		1.25
Machias, N. Y.	.95	.95	1.25	.85	.85	.85
Pittsburgh, Pa.	1.15	1.15	1.15	1.15	.70	.70
Portland, Maine		.50	1.75		1.35	1.35
Washington, D. C. (rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.40	.40				.90
Barton, Wis.		.60	.70	.70	.70	.70
Beloit, Wis.		.50			.50	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	65	.90	.90	.90	.90
Columbus, Ohio	.75	.75@1.00	.75	.75@1.00	.75@1.00	.75
Des Moines, Ia.	.50	.40	1.50	1.50	1.50	1.50
Detroit, Mich.	.65	.65	.95	.95	.95	.95
Earlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	.40@ .50	.40	1.25	1.00		.90
Elkhart Lake, Wis.	.56	.40	.66	.50	.50	.50
Ft. Dodge, Ia.		1.22		2.17		
Grand Rapids, Mich.		.50		.80		.70
Greenville, Mechanicsburg, O.	.65	.65	.65	.65	.65	.65
Hamilton, Ohio		.90			.90	
Hawarden, Ia.		.50			1.60	
Hersey, Mich.					.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Libertyville, Ill.		.50		.70		
Mankato, Minn.—Pit Run	.50	.40	.40		1.25	
Mason City, Ia.	.65	.55	1.70	1.60	1.55	1.55
Milwaukee, Wis.	1.06	1.06	1.26	1.26	1.26	
Minneapolis, Minn.	.35	.35	1.25	1.25	1.25	1.25
Moline, Ill.	.60	.60	1.20	1.20	1.20	1.20
St. Louis, Mo., f. o. b. cars	1.10	1.30	1.50	1.30		1.25
St. Louis, Mo., delivered on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.60	.75	.85	.75	.60@ .75
Waukesha, Wis.	.60		All other sizes, .70 per ton			
Winona, Minn.	.50	.40	1.00	1.25	1.00	1.00
Yorkville, Sheridan, Moronts, Oregon, Ill.	.60	.50@ .70		.60@ .80	.50@ .70	.60
SOUTHERN:						
Alexandria, La.		.70			1.20@1.35	
Birmingham, Ala.	1.48		all gravel—1.88			
Charleston, W. Va.		1.40				1.50
Estill Springs, Tenn.	1.35	1.15		1.00	.85	.65
Ft. Worth, Tex.		2.00		2.00		2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	.75	1.00	1.50	1.50	1.50	1.50
Lake Weir, Fla.		60				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.12	1.12				1.95
N. Martinsville, W. Va.		1.00		1.20		.80
New Orleans, La.		.50			1.00	
Pine Bluff, Ark.	1.20	.90	Washed gravel, all sizes, 2.25			
Roseland, La.		.25	.85	.85		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	(Kaw River sand, car lots, .75 per ton. Missouri River, .85)					
Los Angeles, Calif.		1.00		1.50	1.50	
Pueblo, Colo.	1.10*	.90*		1.50		1.50*
San Diego, Calif.	.80@1.00	.80@1.00	1.30@1.60	1.25@1.55	1.15@1.45	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	85@1.00	.85@1.00
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*		1.00*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch	Sand, ¼ inch	Gravel, ½ inch	Gravel, 1 inch	Gravel, 1½ inch	Gravel, 2 inch
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dudley, Ky. (Crushed Sand)	1.00	1.00		.95		
East Hartford, Conn.			.65 per cu. yd.			
Estill Springs, Tenn.						.85
Fishers, N. Y.		.50@ .70		.50@ .60		
Hamilton, Ohio			.40 per cu. yd. in pit			
Hartford, Conn.		1.00*				
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Tex.	1.00					.55
Janesville, Wis.		.65			.65@ .75	
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.		.75				
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			60% gravel, 40% sand, 1.40			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Tex.		.80		1.50		1.30
Winona, Minn.			Clean pit run .50@.60			
York, Pa.		.95@1.20	(crushed rock sand)			

*Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.00	2.50	1.35	1.25	2.15	2.15
Eastern Pennsylvania and Northern New Jersey	1.25	1.25	1.50	1.25	1.25	1.25	1.25
Easton, Pa.	2.00	.80	1.25	.90	.90	.90	.90
Erie, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.	......	......	1.25	1.25	1.25	1.25	1.25
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.00	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, 1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ironton, O.	2.05	Other grades 1.45					
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.92	1.67	1.77	1.77	1.77	1.67	1.67
	(Any delivery in city except team track deliveries)						
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
Steubenville, Lowellville and Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.	......	1.55	......	1.55	1.55	1.55	1.55
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton & Low Moor, Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing Hydrate	Masons' Hydrate	Agricultural Hydrate	Chemical Hydrate	Ground Burnt Lime Blk.	Ground Burnt Lime Bags	Lump Lime Blk.	Lump Lime Bbl.
EASTERN								
Adams, Mass.	......	......	7.00	......	......	......	......	3.50
Bellefonte, Pa.	......	......	8.00	9.00	8.00	......	7.00	......
Berkley, R. I.	......	......	12.00	......	......	......	......	2.30
Buffalo, N. Y.	10.50	9.00	8.50@11.00	11.00	7.25	9.25	8.00	1.50
Chaumont, N. Y.	......	......	......	......	2.50	4.00	......	......
LeMoyne, Pa.	......	......	......	......	5.00	......4.75@5.00......		
Lime Ridge, Pa.	......	......	......	......	......	......	5.00	......
West Rutland, Vt.	13.50@14.00	11.00@11.50	11.00@11.50	13.50	10.00	......	11.00	3.50
West Stockbridge, Mass.	......	......	15.00	......	......	......	......	......
Williamsport, Pa.	......	......	10.00	......	......	10.00	6.00	......
York, Pa. (dealers' prices)	......	10.50	10.50	11.50	10.50	......	8.50	1.65*
CENTRAL:								
Cold Springs, Ohio	10.50	9.00	8.50	......	7.25	9.25	8.00	......
Delaware, Ohio	10.50	9.00	8.00	10.00	......	......	8.00	1.50
Gibsonburg, Ohio	10.50	8.50	8.50	......	7.25	9.25	8.00	......
Huntington, Ind.	10.50	9.00	8.50	......	......	......	8.00	1.70*
Luckey, Ohio	10.50	9.00	8.00	......	......	......	8.00	......
Marblehead, Ohio	10.50	9.00	8.50	11.00	7.25	9.25	8.00	1.50*
Mitchell, Ind.	......	11.00	11.00	11.00	9.50	......	8.50	1.45
Sheboygan, Wis.	......	......	......	......	......	......	......	7.50d
White Rock, Ohio	10.50	9.00	8.50	11.00	7.25	9.25	8.00	1.50
Woodville, O. (dlrs.' price)	10.50d	9 00d	8.00d	10.00d	7.25	......	......	1.50
SOUTHERN:								
Erin, Tenn.	......	......	......	......	......	......	6.00	1.00
Karo, Va.	......	......	......	......	......	......	7.00	1.30
Knoxville, Tenn.	22.00	9.50@11.00	9.50	10.50	......	......	7.50	1.30
Ocala and Zuber, Fla.	12.50	......	......	12.00	......	......	11.00	1.65
Sherwood, Tenn	11.00	9.50	......	......	7.50	......	7.50	......
Staunton, Va.	......	......	......	......	8.00	......	9.50b	1.60
WESTERN:								
Colton, Calif.	......	......	15.00	......	......	......	19.70	......
Kirtland, N. Mex.	......	......	......	......	......	......	12.50	......
San Francisco, Calif.	22.00	22.00	15.00	22.00	......	......	......	2.15*
Tehachapi, Calif.	......	......	......	......	......		13.00	2.00

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §Paper sacks. (a) 50-lb. paper bags; terms, 30 days net; 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice. (b) Burlap bags. (c) 200-lb. bbl. (d) per ton.

Miscellaneous Sands

(Continued from preceding page)

Delaware, N. J.—Molding fine 2.00
Molding coarse 1.90
Brass molding 2.15
Dresden, O.—Core and traction 1.00
Molding, fine and coarse 1.25
Brass molding 1.50
Dunbar, Pa.—Traction, damp 2.00
Dundee, O.—Glass, core, sand blast, traction 2.50
Molding fine, brass molding (plus 75c for winter loading) 2.00
Molding coarse (plus 75c for winter loading) 1.75
Eau Claire, Wis.—Core 1.00
Sand blast .... 3.25@3.75
Falls Creek, Pa.—Molding, fine and coarse 1.75
Sand blast 3.00
Traction 1.75
Franklin, Pa.—Core .... 1.25@1.75
Furnace lining 2.50
Molding fine 2.00
Molding coarse 1.75
Brass molding 2.00
Greenville, Ill.—Molding coarse .... 1.00@1.40
Joliet, Ill.—Milled, dried and screened No. 2 coarse molding sand and open hearth loam and luting clay .... .60@ .80
Kansas City, Mo.—Missouri River core .... .80
Kasota, Minn. — Molding coarse and fine, stone sawing (pit run) 1.75
Klondike, Pacific and Gray Summit, Mo.—Molding fine and core .... **1.75@2.00**
Mapleton, Pa.—Glass sand, core, furnace lining, molding fine and coarse; dry, 2.50; damp 2.00
Massillon, O. — Traction, molding fine and coarse, furnace lining, core 2.25
Michigan City, Ind.—Core, traction .... .40@ .45
Mineral Ridge, Ohio—(Green) core 2.25
Furnace lining, molding fine and coarse, roofing, sand blast, stone sawing and traction, brass molding 2.00
Montoursville, Pa.—Core .... 1.50@1.75
Traction .... 1.00@1.25
Molding fine 1.50
Molding coarse .... 1.50@2.00
New Lexington, O.—Molding fine 2.00
Molding coarse 1.75
Oregon, Ill.—Core, furnace lining, molding fine and coarse, traction .... .75
Brass molding .... .75
Sand blast 3.00
Ottawa, Ill.—Core, furnace lining, steel molding .... .75@ .90
Roofing sand .... .75@3.50
Sand blast 3.50
Ottawa, Minn.—All crude silica sand .... .75@1.25
Pelzer, S. C.—Glass sand (carload lots only) .... .70
Rockwood, Mich.—Core, damp 2.00
Roofing 2.50
Sand blast 3.75

Miscellaneous Sands

(Continued)

Round Top, Md.—Glass sand .... 1.75@2.00
Core, furnace lining 1.45
Traction 1.60
(All per 2000 lbs.)
San Francisco, Cal. (Washed and dried)—Core, molding fine, roofing sand and brass molding .... 3.00@3.50
Direct from pit.
Furnace lining, molding coarse, sand blast 3.60
Stone sawing, traction 2.30
Thayers, Pa.—Core 1.75
Furnace lining 1.00
Molding fine and coarse 1.25
Traction 1.75
Utica, Ill.—Core .... .60@1.00
Furnace lining .... .50@1.00
Molding fine .... .50@1.00
Roofing sand 1.00
Sand blast 2.50
Stone sawing .... 1.00@2.50
Traction and brass molding 1.00
Utica, Pa.—Core .... 1.25@2.25
Molding fine and coarse, traction, brass molding 2.00
Warwick, O. — Core, furnace lining, molding fine and coarse (damp, 1.75) dry 2.00
Traction (dry) 2.00
Zanesville, Ohio — Brass molding and molding fine .... 1.50@1.75
Molding coarse .... 1.25@1.50

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Asheville, N. C.—Ground talc (150-200 mesh), 200-lb. bags, per ton .... 8.00@14.00
Pencils and steel workers' crayons, per gross .... 1.25@ 2.50
Tailors' chalk, per gross 1.50
Baltimore, Md.—Crude Talc 3.50
Ground talc (20-50 mesh), bags 10.00
Cubes 50.00
Blanks, per lb. .... .07
Chatsworth, Ga.—Crude talc 7.00
Ground talc (150-200 mesh); bags 12.00
Pencil and steel workers' crayons .... 1.50@ 2.50
Chester, Vt. — Ground talc (150-200 mesh) .... 7.00@ 9.00
Emeryville, N. Y.—200-325 mesh; bags 14.75
Glendale, Calif. — Ground talc (150-200-mesh) .... 16.00@30.00
(Bags extra)
Ground talc (50-300 mesh) .... 13.50@15.50
200 mesh .... 13.50@14.50
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags 18.00
Henry, Va.—Crude talc (lump mine run), per 2000-lb. ton .... 2.75@ 3.50
Ground talc (20-50 mesh) .... 5.75@ 6.00
(150-200 mesh) bags .... 8.75@12.00
Johnson, Vt. — Ground talc (20-50 mesh), bulk 7.50; (150-200 mesh) .... 8.00@15.00
(Bags extra)
Ground talc (150-200 mesh), bulk .... 10.00@15.00
(Bags extra)
Los Angeles, Calif.—Ground talc (200 mesh) (includ. bags) .... 15.00@20.00
(150-200 mesh) bags .... 16.00@40.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk 4.00; bags 5.00
(150-200 mesh); bulk 6.00; bags 7.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags .... 12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk .... 8.50@10.00
(Bags extra)
Ground talc (150-200 mesh), bulk .... 10.00@22.00
(Bags extra)
Vermont—Ground talc (20-50 mesh); bags .... 7.50@10.00
Ground talc (150-200 mesh); bags 8.50@15.00
Waterbury, Vt. — Ground talc (20-50 mesh), bulk 7.50
(Bags 1.00 extra)
Ground talc (150-200 mesh), bulk .... 9.00@14.00
(Bags 1.00 extra)
Pencils and steel workers' crayons, per gross .... 1.20@ 2.00

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75% 6.00@8.50
B.P.L. 65% 6.00
Gordonsburg, Tenn—B.P.L. 70%-72% 4.00@5.00
Tennessee—F. o. b. mines, long tons, unground Tenn. brown rock, 72% B. P. L. 7.00
Mt. Pleasant, Tenn. — Analysis, .70 B.P.L. (2000 lbs.) 6.50
Montpelier, Idaho—70% B.P.L.—Crude 4.75
Crushed 2-in. ring and dried 5.00
Paris, Idaho.—2,000 lb. mine run, B.P.L. 70% 4.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f.o.b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$ 9.30	$8.40	$8.10	$7.80
24x14	9.30	8.40	8.10	7.80
22x12	10.80	8.70	8.40	9.10
22x11	10.80	8.70	8.40	9.10
20x12	10.80	8.70	8.40	9.10
20x10	11.70	9.00	8.70	8.40
18x10	11.70	9.00	8.70	8.40
18x 9	11.70	9.00	8.70	8.40
16x10	11.70	8.40	8.40	8.10
16x 9	11.70	8.40	8.40	8.10
16x 8	11.70	8.40	8.40	8.10
18x12	11.10	8.70	8.40	8.10
16x12	11.10	8.70	8.40	8.10
14x10	11.10	8.40	8.10	7.80
14x 8	11.10	8.40	8.10	7.80
14x 7 to 12x6	9.60	8.40	8.10	......
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$7.50	$7.20	$5.75
22x11	8.40	7.80	7.50	5.75
Other sizes	8.70	8.10	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.
Granulated slate per net ton f. o. b. quarries, Vermont and New York, 7.50.

(Continued from preceding page)

Ground Rock

Wales, Tenn.—B.P.L. 70%	7.75
Per 2000-lb. Ton	
Barton, Fla. — Analysis, 50% to 65% B.P.L.	3.50@6.00
Centerville, Tenn.—B.P.L. 65%	6.00
B.P.L. 75% (brown rock)	12.00
Columbia, Tenn.—B.P.L. 68% to 72%	5.50
B.P.L. 65% (90% thru 200 mesh) bulk	5.50
Morriston, Fla.—Analysis, 35% B.P.L.	12.00
Mt. Pleasant, Tenn.—B.P.L. 70%	7.00

Florida Soft Phosphate

Raw Land Pebble

	Per Ton
Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Florida—F. o. b. mines, long ton, 68/66% B.P.L.	3.00
68% (min.)	3.25
70% (min.)	3.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

	Per Ton
Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Lakeland, Fla.—B.P.L. 60%	6.00
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.	6.00@ 7.00

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	12.00@16.00	9.00@12.00
Granville, N. Y. — Red slate granules		7.50
Ingomar, Ohio	12.00@25.00	12.00@25.00
Lincoln, Neb. — Red, white, grey, in bags		30.00
granite; sacks	28.50@30.00	20.00@22.50
Milwaukee, Wis.		30.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		
Phillipsb'g, N. J.—Green stucco dash		9.00@14.00
Piqua, O.—Marble		7.00@ 9.00
Poultney, Vt. — Roofing granules		3.75
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.	12.00	14.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags 10c extra	5.00	5.00

Concrete Brick

Prices given per 1,000 brick, f. o. b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	20.00	25.00@35.00
Bellows Falls, Vt.	18.00	25.00
Birmingham, Ala.	13.50	25.00@35.00
Carpenterville, N. J.	16.00	31.00@48.00
Easton, Pa.	16.00	40.00@60.00
Eugene, Ore.	22.50@25.00	50.00@75.00
Rochester, N. Y.	21.00	
Friesland, Wis.	20.00	
Houston, Tex.		19.50
Lockport, N. Y.	16.00	
Omaha, Neb.	18.00	30.00
Piqua, O.	15.00	25.00
Portland, Ore. (Del'd)	21.00	30.00@60.00
Puyallup, Wash.	18.00	30.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@40.00
Salem, Ore.	25.00@30.00	35.00@75.00
Salt Lake City, Utah	18.00	35.00
Seattle, Wash.	18.00@22.00	35.00@75.00
Springfield, Ill.	18.00	29.00@25.00
Tampa, Fla.	15.00	25.00@65.00
Wauwatosa, Wis.	13.00@14.50	30.00@65.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	7.00
Barton, Wis.	8.50
Boston, Mass.	13.00@14.00
Brighton, N. Y.	14.75
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
El Paso, Texas	12.00
Grand Rapids, Mich.	12.25
Lancaster, N. Y.	12.75
Michigan City, Ind.	10.00
Milwaukee, Wis.	12.00@13.00

Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00
Redfield, Mass.	15.00
Rives Junction, Mich.	11.00
Saginaw, Mich.	11.50
San Antonio, Texas—Common	15.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	18.00
F. o. b. cars	14.00
Washington, D. C.	13.50
Winnipeg, Can.	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Hydrate per Ton Common
Atlanta, Ga.	19.00	16.00
Baltimore, Md.	15.00	13.00
Boston, Mass.	23.00	20.00
Cincinnati, Ohio	19.60	14.50
Chicago, Ill.	18.00	......
Dallas, Tex.	25.00	......
Denver, Colo.	30.00	......
Detroit, Mich.	15.25	13.25
Fort Dodge, Ia.	19.70	*7.00
Grand Rapids, Mich.	15.65	......
Los Angeles, Calif.	30.00	30.00
Minneapolis, Minn.	29.00	22.00
Montreal, Que.	21.00	21.00
New Orleans, La.	......	17.25
New York, N. Y.	16.99	......
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	18.00
Seattle, Wash.	27.00	......

	Lump per 180-lb. Barrel (net) Finishing	Lump per 180-lb. Barrel (net) Common
Atlanta, Ga.	2.00	1.50
Baltimore, Md.	......	12.00†
Boston, Mass.	3.35	3.10
Cincinnati, Ohio	......	12.25
Chicago, Ill.	......	1.40
Denver, Colo.	......	2.95
Detroit, Mich.	11.50†	10.50†
Los Angeles, Calif.	3.00*	3.00*
Minneapolis, Minn.	1.70	1.40
New Orleans, La.	......	1.75
New York, N. Y.	......	3.69*
St. Louis, Mo.	......	.70*
San Francisco, Calif.	......	1.90
Seattle, Wash.	3.25	2.75
Sheboygan, Wis.	......	10.00

*280-bbl. (net). †Per ton.

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags.

Atlanta, Ga. (bags)	3.45
Boston, Mass.	2.61
Cedar Rapids, Iowa	2.33
Cincinnati, Ohio	2.38
Cleveland, Ohio	2.31
Chicago, Ill.	2.05
Dallas, Tex.	2.25
Davenport, Iowa	2.28
Denver, Colo.	2.65
Detroit, Mich.	2.33
Duluth, Minn.	2.04
Indianapolis, Ind. (cloth)	2.66
Kansas City, Mo.	2.30
Los Angeles, Calif.	3.06
Milwaukee, Wis.	2.22
Minneapolis, Minn.	2.29
Montreal, Can. (sacks 20c extra)	2.40
New Orleans, La.	2.80
New York, N. Y. (includes bags)	2.40
(10c per bbl. discount in 10 days)	
Pittsburgh, Pa.	2.09
Portland, Ore.	3.05
St. Louis, Mo.	2.10
San Francisco, Calif.	2.63
St. Paul, Minn.	2.29
Toledo, Ohio	2.33
Seattle, Wash.	2.90

NOTE—Add 40c per bbl. for bags.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agri-cultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	......	......	6.00	13.00	......	10.50@12.00	......	......	......	11.50@13.50	......	......	......
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	......	21.30	20.00	20.00	......	30.00
Garbutt, N. Y.	......	......	6.00	8.00	10.00	10.00	......	7.00	......	......	......	20.00	......
Grand Rapids, Mich.	3.00	......	6.00	8.00	10.00	10.00	......	......	31.25	21.00	19.38	20.00	30.00
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	......	......	......	......	28.50	......	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton additional; ||Bulk; (a) Includes sacks.

News of All the Industry

Incorporations

The Yaeger Rock Co., Fullerton, Calif., has been incorporated at $200,000.

The Iron Ore Gravel Co., Orange, Texas, has been incorporated at $10,000 by B. N. Akin, Len Fruter and Lee Woodworth.

The Oneida Sand Co., Booneville, N. Y., has been incorporated at $150,000 by W. D. Dodge, H. Barnard and F. A. White.

The Star Sand Co., Pittsburgh, Pa., has been incorporated at $25,000 by C. E. Frankenburger, Phil Kussart, Pittsburgh, T. J. Chantler, Beaver.

The Deering Sand & Gravel Co., Portland, Maine, has been incorporated for $50,000. Officers are: M. Di Santo, president; R. Kennedy, treasurer.

The River Stone Co. has been incorporated in Richmond, Va., with a capital stock of $50,000, by Cyrus W. Beale, president; M. Matthews, secretary, and others.

The Pilot Knob Sand and Gravel Co. has been incorporated in Ashland, Ky., with a capital of $250,000 with George B. Williams as president; Sam J. DeBord, secretary and treasurer.

The Georgia Sand and Gravel Co. has been incorporated in Augusta, Ga., with a capital of $50,000, by George R. Lombard, W. W. Ramsey and Thomas N. Hardin.

The Chazy Limestone Corp., New York City, has been incorporated with a capital of $300,000 to do mining, quarrying and a general supply business. The incorporators are W. H. Williams and Lyon Mountain.

Lime

The Southern States Lime Corporation, Crab Orchard, Tenn., will erect a $20,000 hydration plant.

The Southern States Lime Corporation, Charleston, S. C., will erect a 50x75 ft. construction plant and install equipment.

The Maryland Calcite Co., Texas, Md., recently incorporated, has elected R. L. Lovell as president; Richard E. Tome, secretary; Peter Tome, treasurer. The plant to be established will produce stucco dash, whiting, marble flour and sand.

Dealers

The Central Illinois Sand and Gravel Co., Decatur, Ill., has been dissolved.

The Forrer Lime, Cement and Coal Co. has been incorporated in Milwaukee, Wis., with a capital of $50,000 by Fred Forrer and Rudolph F. Forrer.

The Cheever-Tomlinson Lumber Co., Superior, Wis., has been incorporated at $60,000 to deal in lime, cement, plaster, etc., by I. T. Lovejoy, P. S. Robertson and P. J. E. Wood.

The Clinchfield Sand and Feldspar Corp., has been formed in Bristol, Va., with a capital of $600,000, with Henry N. Hanna, 206 Water street, Baltimore, Md., as president, and George M. Warren, Bristol, secretary.

Quarries

The Andres Stone and Marble Co., a Wisconsin corporation, has been qualified to do business in Indiana in general contracting and construction work. The agent is S. J. Crumpacker, South Bend.

Pottstown, Pa.—Fire of undetermined origin destroyed the plant of Storb Crushed Stone Co. at Pine Forge, four miles north, causing a loss of $75,000. This was the second time fire destroyed this company's plant in less than three years.

The Birdsboro Stone Co., Birdsboro, Pa., recently blasted 350,000 tons of rock with 20 tons of dynamite. The trap rock quarries are located in the Hopewell Hills. The large initial crushers of this company will take stone of 7 cu. ft. The company reports a big demand for this stone.

Schroder, Pa.—The National Limestone Co. is so pressed with orders for crushed limestone, and other grades of stone for state road work that it has put on a night force in order to catch up. There are many miles of state road building in Mifflin county and the company has ordered new equipment to meet the demand.

Decatur, Ind.—The Troy Huey stone crusher and 80 acres of land in Jefferson township, has been sold to J. W. Karch, Celina, Ohio, and will become a part of his large equipment. The Huey property was leased by the Erie Stone Co., but has been operated by Mr. Huey again in the past several years.

The Mount Pleasant Stone Co., Mount Pleasant, Iowa, is making extensive improvements and additions to double capacity. New quarrying equipment, shovels, washing plant and screening plant will be added and complete operations laid out on a modern basis. Waller Crow, Inc., 327 South La Salle street, Chicago, are the engineers in charge of all work and specifications.

Sand and Gravel

The Keener Ore and Gravel Co. is reported to have in contemplation the erection of a plant in Poplar Bluff, Mo.

Mt. Vernon—The Evansville Sand and Gravel Co. is repairing its local plant in anticipation of road work to be done in the country.

The Acme Sand Co., Eustis, Fla., will install a 50-hp. oil engine and an 8-in. centrifugal sand pump. L. D. Wylly is manager.

The Georgia Sand and Gravel Co., Augusta, Ga., E. W. Hancock, manager, contemplates enlarging its plant, which now has a daily capacity of 500 tons washed sand and gravel.

Osceola, Mo.—A speed test made recently at the Sac River Sand and Gravel Co. plant showed that it took just one minute and ten seconds to drag a 1½-yd. bucket full of sand from the Osage River.

Horatio, Mo.—R. A. Gibson, Shreveport, La., has been inspecting the gravel deposit in the bed of Little River about a mile below here, with a view to installing a dredge for removing it for commercial use.

Waukegan, Ill.—Work has been started by the Interstate Sand and Gravel Co. on the old gravel pit near Libertyville, from which it plans to take gravel for the new concrete road being built there. The work will be done by a "sand-sucker." The A and A Electric Co., Waukegan, is installing a 350-hp. motor which will run the big centrifugal pump on the dredge.

Horatio, Ark.—Machinery has been unloaded here for building the dredge boat which will be used in removing the gravel from Little River, about a mile below Horatio. Workmen are now engaged in clearing the right-of-way for a spur track from the K. C. S. railroad to facilitate loading. R. A. Gibson, Shreveport, La., is developing the project. It is said that a large amount of commercial gravel will be secured from the river bed.

Evansville, Ind.—William C. Sanderson has purchased a sidewheel steamer 207 by 64 ft. in size and will operate a sand and gravel business at Paducah, Ky., using Evansville as headquarters. The boat holds five railway flat cars. The cars are run on to the boat at an incline, are taken to the scene of sand and gravel digging operations and are filled, being pulled off by railway locomotives when loaded. The plan will give Mr. Sanderson outlet at four points to four different railways. No terminals will be necessary and he will be able to handle 35 to 50 carloads of sand and gravel daily.

Gypsum

Pinielle, Mont.—Owing to the demand for cement and gypsum products, the Three Forks Co.'s plant at Hanover and the Northwest Gypsum Products Co. of Heath are shipping out to coast points over the Milwaukee from four to five cars a day.

Cement

New Castle, Pa.—The new plants of the Lehigh Portland Cement Co. are working 100 per cent of capacity for the first time in over nine months.

Virginia City, Mont.—Owing to the demand for cement and gypsum products, the Three Forks Co.'s plant at Hanover and the Northwest Gypsum Products Co., Heath, are shipping out to coast points over the Milwaukee from four to five cars a day.

Copley, Pa.—With the operation of Mill A of the Lehigh Portland Cement Co., every mill in the Lehigh cement region is working full capacity for the first time in years. The cement is being shipped almost as quickly as it is made and an excellent demand is being encountered.

Allentown, Pa.—With the putting into operation of Mill A of the Lehigh Portland Cement Co., all the cement mills in the Lehigh district are running practically at capacity for the first time in several years. There is a good demand and the prospects are for continuous operation.

El Paso, Texas—Increased business at the Southwestern Portland Cement Co.'s plant has made necessary the addition of another crushing mill, O. J. Binford, superintendent, said Tuesday. The plant is operating at full capacity and will be working on present orders the remainder of the year. With the addition of a third mill, the daily capacity has been increased to approximately 15,000 sacks. There are more than 300 men on the payroll. Three eight-hour shifts are worked.

Cement Products

The Concrete Pipe Co., Portland, Ore., will build a two-story addition, 120x140 ft., to its factory at a cost of $20,000.

Leak & Horn, Essington, Pa., who recently embarked in the cement brick business have placed an order for a brick machine which is expected to arrive daily. They have many inquiries about their blocks and are hopeful of doing an extensive business.

Frankford, Ind.—Samuel Rogers has been awarded the contract to make the cement blocks used in foundation work for the new buildings which the R. D. Voorhees Co. will erect on North Jackson street. The job will require several thousand blocks.

Topeka, Kans.—A plant for manufacturing concrete blocks and building tile is to be built at Purcell, on the old Federated mining lease, by E. B. Smith, Joplin, owner of the lease. Work on the new plant has started and it is expected that it will be ready for operation within six weeks. Much of the machinery already is on the ground. The capacity of the plant, when running full force, will be 16,000 concrete building blocks and 3,000 tile a day, and Mr. Smith states that it will be the largest plant of its kind this side of Omaha. The chats on the old Federated mining ground will be used in the manufacture of the blocks and tile.

Lansing, Mich.—Edward B. Ramsey was elected president of the Lansing Cast Stone Co. at a meeting of the company. No other changes were made. The company was started in Lansing by Bay City capital, the Lansing capital later coming in. The company manufactures waterproof cement block with a granite like facing that has been much in demand for homes and for school houses. It is understood that the company, now capitalized at $30,000, may be recapitalized for the purpose of increasing its field, adding to capacity and manufacturing new lines of building material. The plan is now being taken under advisement by the directorate.

Personal

Earl Zimmerman, formerly assistant general manager of the Ohio Gravel Ballast Co., Cincinnati, Ohio, has been promoted to the office of general manager.

Used Equipment

Kates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum cnarge, $2.50. Please send check with your order. These ads must be paid in advance of insertion

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Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

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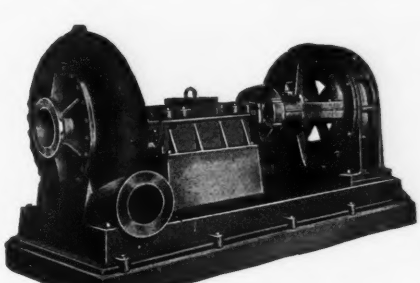

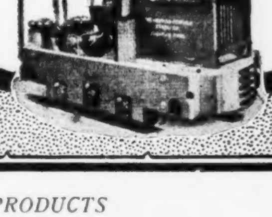

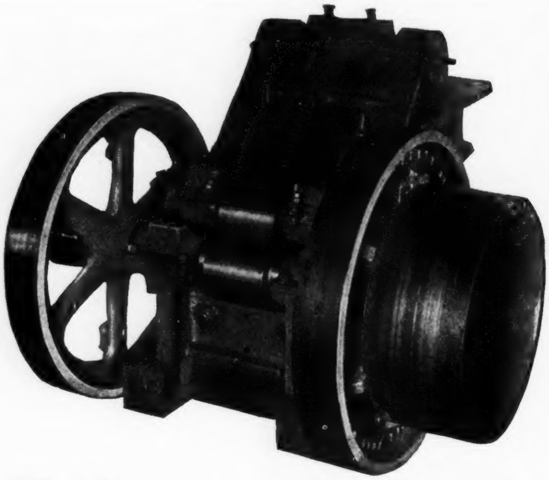

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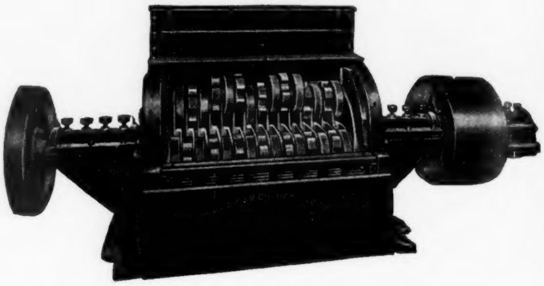

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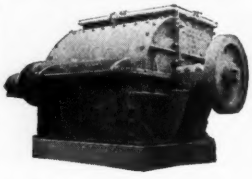

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THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

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The Clyde was first in the field, and through dependable and economical performance is still first choice of lime operators.

The Clyde Hydrator produces big capacities of lime at only three-fifths the cost of any other hydrator on the market.

The Clyde not only produces over 90% of the hydrate of America, but makes the best quality of finishing lime from either high calcium or magnesium.

Simple, easiest to operate and most economical in cost of installing, maintaining, and operating.

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Date Patented	Serial Number
April 3, 1900	646544
October 10, 1905	801329
November 29, 1921	1398238

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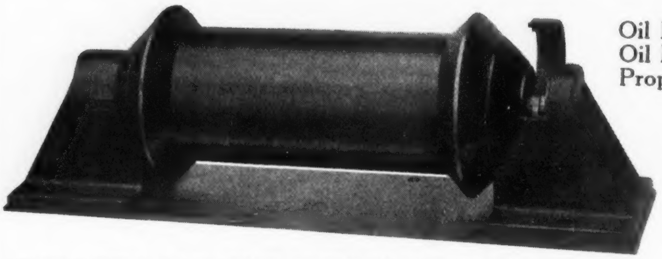

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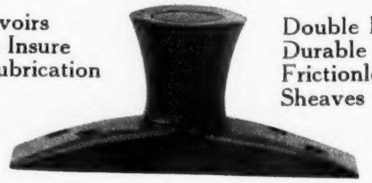

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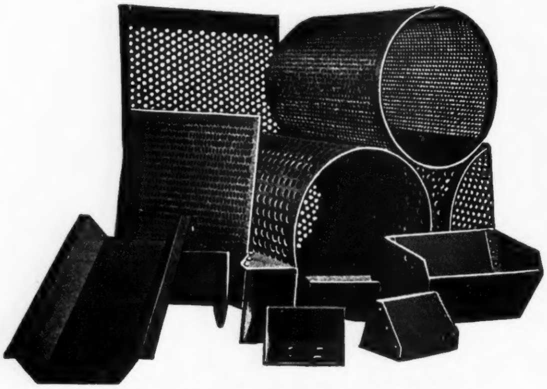

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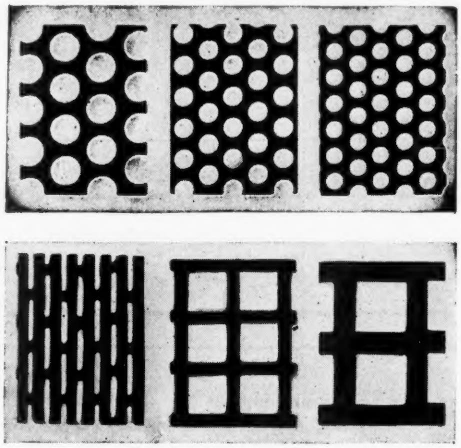

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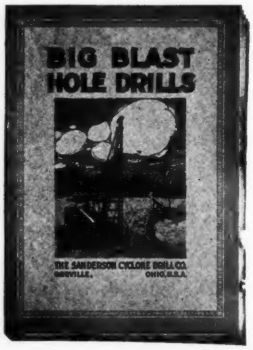

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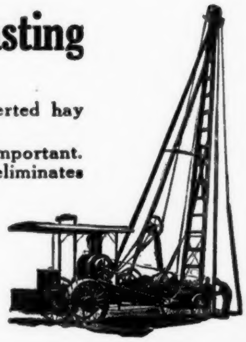

THE SANDERSON-CYCLONE DRILL CO.

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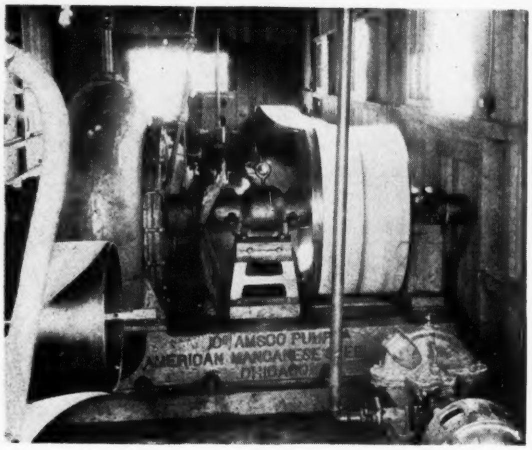

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Power Capacity Ruggedness

The engraving here shows an AMSCO installation at the Rock Island Sand and Gravel plant, Rock Island, Ill.

This 10-in. pump is driven by a 200 H. P. motor, belt connected, and the average distance from pump to plant is 500 ft.

While this is a new plant, the pump has been thoroughly tested, proving it to be a remarkably fine performer, particularly free from need of constant and petty adjustments.

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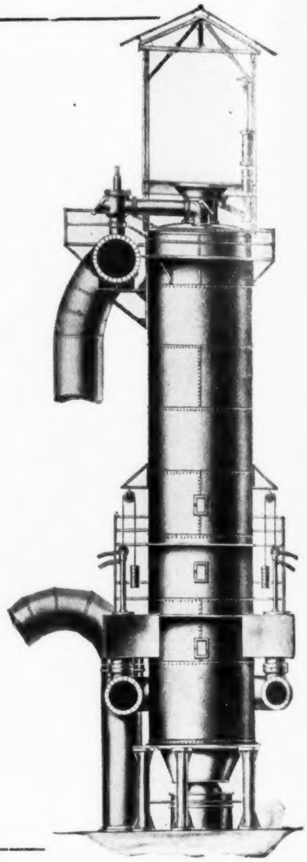

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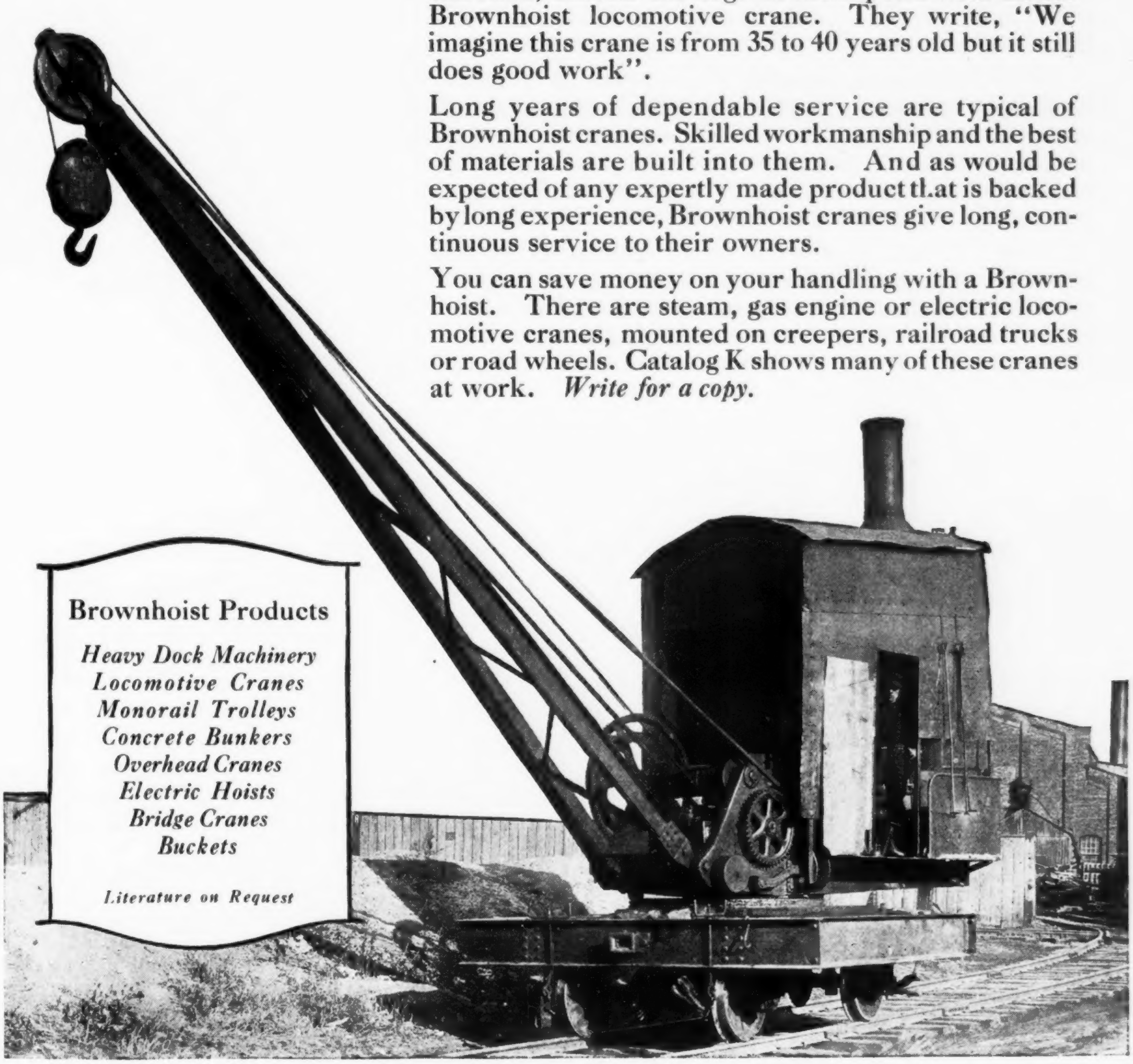

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